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No. 83-

IN THE

Supreme Court of the United States

OCTOBER TERM, 1983

ALABAMA POWER CO., *et al.*,
Petitioners,

v.

SIERRA CLUB, *et al.*,
Respondents.

APPENDIX TO PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA CIRCUIT

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ALABAMA POWER COMPANY, et al.,
KENNECOTT MINERALS CO.,
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v.

U.S. ENVIRONMENTAL PROTECTION AGENCY, and ANNE M. GORSUCH, ADMINISTRATOR, RESPONDENTS

STATES OF NEW YORK, et al.,
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No. 82-1845

SIERRA CLUB and NATURAL RESOURCES DEFENSE COUNCIL, INC., PETITIONERS

v.

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No. 82-1889

COMMONWEALTH OF PENNSYLVANIA, PETITIONER

v.

U.S. ENVIRONMENTAL PROTECTION AGENCY, and ANNE M. GORSUCH, ADMINISTRATOR, RESPONDENTS

ALABAMA POWER COMPANY, et al., AMERICAN PETROLEUM INSTITUTE, et al., INTERVENORS

Petitions for Review of Orders of the Environmental Protection Agency

Argued April 18, 1983

Decided October 11, 1983

Richard E. Ayres and *Howard I. Fox*, for petitioners in Nos. 82-1384 and 82-1845.

Thomas Y. Au, Assistant Counsel, Commonwealth of Pennsylvania, was on the brief for petitioners in Nos. 82-1412 and 82-1889.

Catherine A. Cotter, Attorney, Department of Justice, of the bar of the Supreme Court of California, *pro hac vice* by special leave of Court, and *Christina Kaneen*,

Attorney, Environmental Protection Agency, of the bar of the Supreme Court of Illinois, *pro hac vice* by special leave of Court, with whom *Carol E. Dinkins*, Assistant Attorney General, Department of Justice, *Robert M. Perry*, General Counsel, and *Charles S. Carter*, Acting Assistant General Counsel, Environmental Protection Agency, were on the brief, for respondents. *Barry S. Neuman*, Attorney, Department of Justice, and *Jesse Carrillo*, Attorney, Environmental Protection Agency, also entered appearances for respondents in Nos. 82-1384, 82-1412, 82-1845 and 82-1889.

Henry V. Nickel, with whom *F. William Brownell* and *Michele Pollak* were on the brief, for intervenors, Alabama Power Co., et al., in Nos. 82-1384, 82-1412, 82-1845, and 82-1889.

Stark Ritchie and *David T. Deal* were on the brief for intervenors, American Petroleum Institute, et al., in Nos. 82-1384, 82-1412, 82-1845, and 82-1889.

Alfred V. J. Prather and *Kurt E. Blase* were on the brief for intervenor Kennecott Minerals Company in No. 82-1384.

James E. Fox was on the brief for intervenor Tennessee Valley Authority in No. 82-1384.

Francis X. Bellotti, *James R. Gomes*, and *Stephen M. Leonard* for Commonwealth of Massachusetts, *Robert Abrams* and *David R. Wooley*, for State of New York, and *Dennis J. Robert, II*, for State of Rhode Island, were on the brief for intervenors, State of New York, et al., in Nos. 82-1384 and 82-1412. *Val Washington* also entered an appearance for State of New York in No. 82-1384.

Before EDWARDS, *Circuit Judge*, MCGOWAN and MACKINNON, *Senior Circuit Judges*.

Opinion for the Court filed by *Senior Circuit Judge* MCGOWAN.

MCGOWAN, *Senior Circuit Judge*: This case concerns the amount of credit electric power plants and other major sources of air pollution may receive for the height of their emissions stacks in calculating limitations on their emission of pollutants.

Under the Clean Air Act as amended ("the Act") and its regulations, emissions limitations for each such source are fixed on the basis of local, ground-level concentrations of pollutants, which cannot exceed certain national standards or incremental increase limitations. Since taller stacks tend to disperse pollutants over a greater area, a utility or other source can lower the ambient pollution concentrations not only by reducing the amount of pollutants it emits into the air, but also by raising the height of its stack. After the basic provisions of the Act were passed in 1970, many chose the latter route. In 1977 amendments to the Act, Congress declared that such tall stacks and other dispersion techniques were not to be taken into account in calculating the limitations on emissions imposed by the Act. 42 U.S.C. § 7423 (Supp. V 1981). Rather, pollution standards were to be achieved by direct limitations on emissions. The present case brings before us final regulations issued by the Environmental Protection Agency (EPA) to implement this provision.

The regulations at issue are detailed and somewhat complex. Generally speaking, under the 1977 amendments credit for stack height in calculating emissions limitations is limited to the height dictated by "good engineering practice" (GEP). *Id.* § 7423(a)(1). This height was defined by Congress to be that necessary to ensure against certain kinds of localized atmospheric disturbance created by the source itself or nearby obstacles, and resulting in excessive concentrations of pollutants in the immediate vicinity of the source. *Id.* § 7423(c). The regulations under review define a number of the statutory terms, such as "nearby" and "excessive," provide

various methods for determining GEP height and determine when each may be used, implement a statutory bar on credit for use of "dispersion techniques" other than stack height, define a statutory "grandfather" clause for pre-1970 stacks, and provide a timetable for implementation of the regulations by the states, which are the primary enforcers of the Act.

We have reviewed carefully the specific provisions challenged here. Among them we find certain aspects of the regulatory scheme to be contrary to the terms of the statute and others to be arbitrary and capricious exercises of the discretion conferred on the EPA by the Act. These provisions must therefore be overturned. We remand certain other provisions for further consideration by the agency in light of our discussion here. The remainder of the challenged regulations we uphold.

I

The events leading up to the enactment of the section of the Clean Air Act Amendments of 1977 involved in this case have been described in our opinion in *Alabama Power Co. v. Costle*, 636 F.2d 323, 388-91 (D.C. Cir. 1979),[1] and in the House committee report accompanying those amendments, H.R. REP. NO. 294, 95th Cong., 1st Sess. 81-92 (1977) [hereinafter cited as HOUSE REPORT]. Briefly, under the drastic overhaul of the Clean

[1] *Alabama Power* brought before this court regulations implementing the Act's prevention of significant deterioration (PSD) program, intended to protect areas still having relatively clean air, 42 U.S.C. §§ 7470-7491 (Supp. V 1981). *See* 43 Fed. Reg. 26,380, 26,388 (1978). Included was a provision that in determining a source's emissions limitations, both the source and surrounding polluters would have their emissions modeled as though they were emitted at GEP height. Industrial petitioners urged that only the emissions from the source itself should be modeled at GEP height; the surrounding facilities should be modeled with their actual stack heights. We upheld the regulation. *See* 636 F.2d at 388-92. The instant case concerns, *inter alia*, the method of setting GEP height for each source.

Air Act undertaken in 1970, EPA was directed to prescribe national ambient air quality standards for various pollutants. 42 U.S.C. § 1857c-4 (1976). Upon promulgation of an air quality standard, each state was required to adopt and submit to EPA a state implementation plan providing for attainment and enforcement of the standard. *Id.* § 7410(a).

Initially, EPA approved state plans that authorized, in place of direct limitations on emissions, the use of tall stacks to meet air quality standards. EPA also allowed the use of other dispersion techniques called supplemental or intermittent control systems, which are programs that vary the release of pollutants over time depending on whether meteorological conditions favor dispersion. EPA's policy was overturned by the courts, which, led by the Fifth Circuit, ruled that the Act allowed reliance on dispersion techniques only after implementation of "the maximum degree of emission limitation achievable." *NRDC v. EPA*, 489 F.2d 390, 410 (5th Cir. 1974), *rev'd on other issues sub nom. Train v. NRDC*, 421 U.S. 60 (1975); *see Kennecott Copper Corp. v. Train*, 526 F.2d 1149, 1151-60 (9th Cir. 1975), *cert. denied*, 425 U.S. 935 (1976); *Big Rivers Electric Corp. v. EPA*, 523 F.2d 16, 20-22 (6th Cir. 1975), *cert. denied*, 425 U.S. 934 (1976). "Informed as well as chastened by these judicial decisions," *Alabama Power*, 636 F.2d at 390, EPA in 1976 issued guidelines that, while placing primary emphasis on emissions reductions, allowed the use of tall stacks to meet ambient standards in two situations: (1) where the source was already using "the best available emission control technology," or (2) where use of such technology would be "economically unreasonable or technologically unsound." Stack Height Increase Guideline, 41 Fed. Reg. 7450, 7451-52 (1976) [hereinafter cited as 1976 Guideline].[2]

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[2] The predecessor to this guideline was evidently issued only after the initiation of a contempt proceeding for failure

Congress emphatically rejected this approach in the 1977 amendment of the Act that is the subject of the present controversy. In introducing the bill on the Senate floor, Senator Muskie criticized the 1976 guidelines for allowing any use of tall stacks whatsoever in meeting ambient standards: "Far from prohibiting the construction of tall stacks or the use of intermittent controls, the guidelines provide that once minimal emission control requirements are met, polluters are encouraged to substitute unlimited stack height for any further control of emissions." 123 CONG. REC. 18,027 (1977). The mood in the House was the same, *id.* at 16,203 (remarks of Rep. Waxman, a sponsor of the House bill) ("The committee has unequivocally rejected the use of tall stacks and intermittent controls as a final means of compliance with the Clean Air Act's requirements."), and in section 123 of the amended Act Congress banned virtually all reliance on tall stacks or "any other dispersion technique" in achieving compliance with ambient air quality standards, 42 U.S.C. § 7423(a) (Supp. V 1981).

Congress did not, however, actually prohibit tall stacks or limit their height; in fact, section 123 specifically enjoins the EPA Administrator ("the Administrator") from prohibiting any increase in stack height or restricting the height of any stack in any manner. *Id.* § 7423(c). Rather, the law limits the credit that may be obtained for such stack height in determining whether the plant will cause ambient air standards to be violated or increase pollution by too large an increment. The credit system is based on techniques of modeling whereby, via

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to comply with the Fifth Circuit's order in *NRDC v. EPA*. *See* NRDC v. EPA, 529 F.2d 755, 760 (5th Cir. 1976) ("We deny the [contempt] motions . . ., noting however, that such motions apparently were necessary to compel the Administrator to respond to our directive issued more than a year before.").

mathematical or small-scale physical demonstrations, a plant's emissions can be assumed to emerge from a certain stack height and then mapped as they fall to earth in order to see their effect on ambient pollution. Thus, section 123 is intended to eliminate any credit a plant might receive for the dispersive effects of a tall stack in the calculation of its emissions limitations, although the stack itself remains in place.

There were essentially three reasons for Congress's refusal to allow reliance on tall stacks and intermittent control measures. First, dispersion techniques do not reduce the amount of pollution in the air, but merely spread it around, exporting it to other areas where it is too late to control the problem, and exposing previously pristine areas to contamination. *See, e.g.*, HOUSE REPORT, *supra* p. 5, at 84-85. Second, the long-range transport of certain pollutants was also linked to the formation of "acid rain," which is precipitation containing acidic derivations of sulfur oxide and nitrogen oxide emissions. Acid rain was thought responsible for reduced soil and water productivity in certain areas, particularly the Northeast and Canada. *See, e.g., id.* at 83-84, 85-86; 123 CONG. REC. 18,026 (1977) (remarks of Sen. Muskie). Third, intermittent control systems, which are dependent on synchronizing plant operation with weather conditions, were thought to be unreliable and virtually impossible to enforce. *See, e.g., id.*; HOUSE REPORT, *supra* p. 5, at 82-83, 87.

In rejecting the limited permission to use dispersion techniques contained in the 1976 guidelines, however, Congress largely adopted the distinction drawn in those guidelines, and in a 1973 stack height proposal, between stack heights that would be allowed without question and those that would be regarded as a dispersion technique. *See id.* at 93 (statute "affirm[s]" the standard used by the Administrator). This distinction is the main battleground of the present litigation. The guidelines had

based the distinction on "good engineering practice," which the preamble to the 1973 proposal defined as follows:

> [A] stack which conforms to good engineering practice is sufficiently tall that emissions from the stack are not significantly affected by the atmospheric downwash, eddies, or wakes created by the facility or nearby structures and terrain. Emissions from stacks which are shorter than required by good engineering practice often can cause excessively high ground level concentrations and nuisances within, and in the immediate vicinity of, the facility.

Use of Supplementary Control Systems and Implementation of Secondary Standards, 38 Fed. Reg. 25,697, 25,700 (1973) (proposed rules) [hereinafter cited as 1973 Guidelines]. Congress appears to have taken the main elements of this statement in its definition of good engineering practice height. Section 123 defines that height as

> the height necessary to insure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies and wakes which may be created by the source itself, nearby structures or nearby terrain obstacles.

42 U.S.C. § 7423(c) (Supp. V 1981).

As the quoted language from the 1973 proposal suggests, downwash, eddies, and wakes are caused by the wind hitting structures or other obstacles near the stack. The turbulence created in the wake of the obstacles tends to suck a plume of emissions down to the earth before it has had a chance to disperse, resulting in inordinately high pollution concentrations near the plant. *See also* HOUSE REPORT, *supra* p. 5, at 93 ("Without some provision for stack height, a plume released downwind of such a structure might become engulfed by turbulent eddys [sic] within the wake of the structure."); 122 CONG. REC. 34,384 (1976) (remarks of Sen. Muskie) ("This is

necessary in order to allow good plume rise without downwashing the plume onto the local area.").

While the statute generally left the determination of GEP stack height to regulations to be promulgated by the EPA Administrator, it set an upper limit of two-and-one-half times the height of the stack's source. 42 U.S.C. § 7423(c) (Supp. V 1981). This, too, was taken from the 1973 and 1976 guidelines. *See* 1976 Guideline, *supra* p. 6, at 7451-52; 1973 Guidelines, *supra* p. 9, at 25,700, 25,701. The formula was seen as codifying "the stack height-nearby structure relationship that has been looked to historically as a responsible way of dealing with the problem of aerodynamic downwash." HOUSE REPORT, *supra* p. 5, at 93. While the guidelines used the two-and-one-half-times standard as the standard GEP stack height, however, Congress was clear in its conference report that the statutory formula was generally intended to be an upper limit, and that if EPA found that the problem of downwash, eddies, and wakes could be prevented by stacks of less than two-and-one-half times facility height, it was to give credit only for the lower height. 123 CONG. REC. 27,071 (1977) (Clean Air Conference Report (1977): Statement of Intent; Clarification of Select Provisions). Nevertheless, like the guidelines, the statute provides that a plant operator can get credit for a greater-than-formula height by demonstrating to the satisfaction of the Administrator that a greater height is needed to prevent the downwash problem described in the Act. 42 U.S.C. § 7423(c) (Supp. V 1981).

In barring any credit for tall stacks and other dispersion techniques, Congress believed it was merely reaffirming a command it had given in the 1970 Clean Air Act amendments. It "intended to ratify the general thrust, if not the specific holdings, of the three U.S. courts of appeals" that had interpreted the earlier Act to bar primary reliance on such techniques. HOUSE REPORT, *supra* p. 5, at 91. As a result, the section's grand-

father clause provides an exemption only for stacks "in existence" or dispersion techniques "implemented" before the date of the 1970 amendments, and not for those built between 1970 and the enactment of the 1977 amendments. 42 U.S.C. § 7423(a) (Supp. V 1981); *see* HOUSE REPORT, *supra* p. 5, at 93.

Section 123 directs EPA to issue regulations implementing these provisions by February 7, 1978, 42 U.S.C. § 7423(c) (Supp. V 1980) ("[n]ot later than six months after August 7, 1977"), and the states are directed to revise their applicable implementation plans, as necessary, within nine months of the promulgation of EPA's regulations, *id.* § 7401 note (the later of one year after enactment of the Act or nine months after promulgation of EPA regulations). Proposed regulations were not issued until January 12, 1979, however. Stack Height Regulations, 44 Fed. Reg. 2608 (1979). Under a court-ordered timetable, *Sierra Club v. Gorsuch*, No. 81-0094 (D.D.C. June 22, 1981, modified Aug. 20, 1981, and Feb. 17, 1982), EPA then issued a revised set of proposed regulations on October 6, 1981, 46 Fed. Reg. 49,814 (1981), and finally issued final regulations on February 8, 1982, 47 Fed. Reg. 5864 (1982) (to be codified in 40 C.F.R. §§ 51.1, 51.12, 51.18). Petitioners NRDC and Sierra Club filed motions for reconsideration on various grounds, all of which were denied. Petitions for review were then filed in this court under the Act's sixty-day review provision. 42 U.S.C. § 7607(b) (Supp. V 1981).

The core of the new regulations is the determination of GEP stack height. The rules provide three methods; a source operator may use whichever of the methods yields the greatest GEP height. First, a "de minimis height" of sixty-five meters is permitted for all sources regardless of the size or location of any structures or terrain features. 47 Fed. Reg. at 5868 (to be codified at 40 C.F.R. § 51.1(ii)(1)). The Administrator stated that this height represented "a reasonable estimate of the

height needed to insure that emissions will not be affected by common ground-level meteorological phenomena which may produce excessive pollutant concentrations." *Id.* at 5865. The de minimis feature is not challenged in this case.

Second, the regulations provide two mathematical formulas, one to be used by stacks in existence on January 12, 1979, the date of publication of EPA's original proposed rules, and the other for stacks whose construction commenced after that date. The formula to be used by the earlier stacks is what the Administrator termed "the traditional engineering formula of two and one-half times the height of the nearby structure" (hereinafter called the 2.5 Rule). *Id.* The second formula is a refinement of the first that is intended to reflect the reduced height needed to surmount the less severe downwash effects produced by tall, thin structures. *See* 46 Fed. Reg. at 49,815. The refined formula gives credit for the height of the nearby structure plus one-and-one-half times the lesser of the height or width of the structure (hereinafter called the 1+1.5 Rule). 47 Fed. Reg. at 5868 (to be codified at 40 C.F.R. § 51.1(ii)(2)(ii)). Under either formula, only "nearby" structures may be used. "Nearby" is defined as a distance from the stack of five times the lesser of the height or width of the structure itself, up to one-half mile. *Id.* at 5869 (to be codified at 40 C.F.R. § 51.1(jj)).

The third method for calculating GEP stack height is by a physical demonstration, either a fluid model or a field study. This method must be used to obtain credit for downwash produced by terrain features or by any obstacle that is not "nearby." The demonstration must show that a greater-than-formula height is needed to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant. *Id.* at 5868-69 (to be codified at 40 C.F.R. § 51.1(ii)(3)). "Excessive concentrations" is defined as maximum concentra-

tions of a pollutant at least forty percent in excess of the maximum concentrations of the pollutant in the absence of the downwash, eddy, or wake effects. *Id.* at 5869 (to be codified at 40 C.F.R. § 51.1(kk)).

We will describe other details of the challenged regulations as needed in dealing with each of petitioners' objections to the new rules. We will discuss first those objections going roughly to the formulation and operation of the three methods, next those going to when the various methods are applied, then objections to certain exemptions from the regulations, then the various grandfather clauses provided by the regulations, and finally an objection to EPA's timetable for state implementation of the regulations.

II

A. *Definition of "Nearby"*

As noted, the new regulations define "nearby" for purposes of application of the formulas as five times the height or width of the structure, up to one-half mile. There is no specific limit on the distance that structures and terrain obstacles may be from the stack in order to be taken into account in a demonstration. NRDC and Sierra Club argue that Congress intended to limit the structures and terrain obstacles that may be said to cause downwash to those within one-quarter mile of the stack, so that the regulations are contrary to law with regard to both the formulas and demonstrations.

The source of petitioners' argument is certain language in the House Report that they say indicates Congress's understanding that "nearby" meant no more than one-quarter mile away. The Report's discussion of the term is as follows:

> In affirming the 2½ times standard used by the Administrator, the committee referred to downwash problems created by both manmade structures and to terrain features located "nearby" the source. The committee intends that the term "nearby" be strictly

> construed, in keeping with the general policy of statutory interpretation favoring strict construction of exceptions and variances. If this term were construed too broadly (*that is, to apply to manmade structures or terrain features one-fourth to one-half mile away from the source or more*), the result could be an open invitation to raise stack heights to unreasonably high elevations and to defeat the basic underlying committee intent.

HOUSE REPORT, *supra* p. 5, at 93 (emphasis added).

EPA apparently selected the one-half-mile limitation solely in response to this expression of congressional intent; it itself believed that downwash effects occur at greater distances from the obstacles and that the five-times-height-or-width rule was a better approximation of the longevity of those effects than is the one-half-mile limit. *See* 44 Fed. Reg. at 2610; 46 Fed. Reg. at 49,819.

We agree that the one-half-mile limitation is a sufficient response to the congressional intent. The statute specifically gives the EPA Administrator discretion to promulgate regulations to determine GEP height and the House report clearly indicates that that discretion extends to defining terms such as "nearby" as necessary, presumably in light of the Administrator's expertise. The report standing alone is ambiguous on whether it was trying to impose a specific limitation on the definition of "nearby," but when read in light of the statute's broad conferral of discretion it is most readily interpreted as an attempt only to suggest the scale of magnitude that the committee had in mind, and not to pick a specific figure. The one-half-mile limitation that EPA chose is at or near the outer edge of the range Congress was thinking of, but it does not go beyond it. Thus, we find the Administrator's choice to be consistent with both the legislative history and the statute.

The refusal to give any content to the statutory term "nearby" when applied to demonstrations is quite a dif-

ferent matter.[3] The rationales offered were that (1) some obstacles create downwash effects at distances of more than one-half mile, (2) the fluid modeling methods would accurately tell precisely when such effects were occurring, and (3) the boundaries of many terrain features are not always distinct and thus a specific distance limitation would be difficult to apply. *See* 46 Fed. Reg. at 49,819; *see also id.* at 49,821 (accuracy of fluid modeling). Thus, the Administrator believed that the statute was intended to allow credit for the height needed to avoid the effects of *any* downwash that could cause excessive concentrations of pollutants.

While such an approach might make a good deal of sense, we do not think it is the approach commanded by the statute. The primary support for the Administrator's reading is that the language from the House Report quoted above, which places great emphasis on the word "nearby" as a carefully imposed limitation on the determination of GEP height, discusses the term only in connection with the formula method, not the demonstration technique. The Report discusses demonstrations in a different paragraph and does not mention the word "nearby" there at all. HOUSE REPORT, *supra* p. 5, at 93.

Moreover, applying the "nearby" limitation only to the formula method and not to demonstrations would certainly be rational because, unlike demonstrations, the formulas do not otherwise select the obstacles to be taken into account. Without some limitation, the for-

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[3] EPA somewhat lamely suggested that the new regulations do in fact give some meaning to the word "nearby" as applied to demonstrations: "Any terrain feature which is close enough to a source to cause excessive concentrations must be considered a 'nearby' feature." 46 Fed. Reg. at 49,819. If this were the statute's command, it would be no different if the word "nearby" did not apply to demonstrations. Thus, "nearby" must effectively be read out of the statute in order to reach EPA's interpretation.

mulas could conceivably be used to give credit for the height of any obstacle upwind of the stack, even though the turbulence created in the wake of those obstacles could not possibly disrupt the plume. Demonstrations, however, do select the obstacles that will be taken into account, because they more accurately tell which will actually cause downwash.

Nevertheless, the legislative history is not explicit enough to refute the clear thrust of the statutory language. In describing the demonstrations that are permitted, the statute states that the operator may show "that a greater height [than two-and-one-half times the height of the source] is necessary *as provided under the preceding sentence.*" 42 U.S.C. § 7423(c) (Supp. V 1981) (emphasis added). The "preceding sentence" defines "good engineering practice" as the height necessary to ensure that excessive concentrations will not result from downwash created by the source, "*nearby* structures or *nearby* terrain obstacles." *Id.* (emphasis added). Thus, the statute explicitly applies the "nearby" limitation to demonstrations.

If such a reading were utterly nonsensical, we might be tempted, as a matter of interpretation of likely intent, to strain the statutory language to arrive at a more rational result. *See, e.g., American Tobacco Co. v. Patterson*, 456 U.S. 63, 71 (1982) ("Statutes should be interpreted to avoid . . . unreasonable results whenever possible."); 2A C. SANDS, STATUTES AND STATUTORY CONSTRUCTION § 45.12 (4th ed. 1973) (same). But such an approach to interpretation of statutes must be used with utmost caution, for the line between irrationality and mere bad policy is a wavering and uncertain one. Here, sense can be made of a limitation on the stack-height credit operators may receive in addition to the requirement that the height be necessary to avoid excessive concentrations of pollutants in the immediate vicinity of the plant. When EPA originally proposed

these regulations in 1979, for example, it apparently intended some version of the "nearby" limitation to apply to demonstrations; it explained that it interpreted "the Congressional guidance as a criterion to indirectly establish a reasonable upper limit on GEP stack heights." 44 Fed. Reg. at 2610; *see id.* at 2611 ("As in the case of GEP determinations using the empirical equation, the definition of 'nearby' is integral to determine the extent to which structures or terrain features may reasonably influence the fluid modeling or field study based GEP determination."). That is, Congress may merely have wanted to place an absolute cap on the credit a source could receive for a tall stack, perhaps out of a distrust of the political and scientific methods by which the agency's determinations of stack height credit were to be made.

In addition, as the Administrator's rationale for eliminating the "nearby" limitation suggests, that limitation will primarily affect sources located in hilly terrain, since it is unlikely that a manmade obstacle will be large enough to create downwash problems at distances of greater than half a mile. Yet there are strong indications in the legislative history that Congress specifically sought to discourage utilities from locating in hilly terrain, because such locations tend to require very tall stacks, leading to greater dispersion of pollutants. For example, the House report states that it was "the expectation of this committee that persons responsible for siting new facilities will not locate them next to terrain features which will produce . . . downwash." HOUSE REPORT, *supra* p. 5, at 93. *See infra* pp. 37-38 (other indications of this intent). Applying the "nearby" limitation to all methods of deriving GEP heights may be further evidence of Congress's lack of solicitude for utilities located next to mountains (as opposed to those located next to very local, and presumably smaller, terrain features that may be surmounted with less stack height).

Finally, even if there is an element of arbitrariness in Congress's applying the "nearby" limitation to demonstrations, we note that the entire GEP stack height allowance was already regarded as something of a concession from the strict command that dispersion not be used to meet air quality standards. Congress may simply have been unwilling to compromise further the predominant purpose of reducing emissions in order to take account of what it may have regarded as fairly attenuated claims of downwash. There is frequently some arbitrariness when a lawmaker says, "Thus far and no further," but such lines frequently must be drawn.

The statutory language must thus be interpreted to apply "nearby" to demonstrations as well as to the formulas as a limitation on the amount of downwash that will be taken into account in giving credit for stack height. We remand, therefore, for the EPA to include new regulations that apply the same "nearby" limitation to demonstrations as is applied to the formulas.

B. *Definition of "Excessive Concentrations"*

When a source owner seeks to obtain credit for stack height greater than provided by the formulas, it must demonstrate that downwash can be expected to cause "excessive concentrations" of pollutants in the vicinity of the plant. The regulations define "excessive concentrations" as a forty-percent increase over the levels in the absence of the downwash-creating obstacle. 47 Fed. Reg. at 5869 (to be codified at 40 C.F.R. § 51.1(kk)).

Petitioners NRDC and Sierra Club argue that such a definition is arbitrary and capricious because it does not measure any absolute amount of pollutant that is a danger to health or welfare, but instead invokes a relative measure. They state that the forty-percent rule would permit a source located in a very clean area to raise its stack height credit, even if the downwash avoided would only increase pollutant concentrations by

a very small amount that would be of no harm to anyone. They urge a return to a standard like the one EPA originally proposed in 1979. Under that standard a source would have had to show that downwash would *both* increase pollutant concentrations by at least forty percent and cause a violation of a national ambient air quality standard or, in certain areas, an incremental increase limitation. 44 Fed. Reg. at 2611.

EPA eliminated the second of these criteria—requiring a violation of an air quality standard—in 1981. It said that its air quality standards and incremental limitations are unable to measure the high pollutant concentrations of extremely short duration that are typical of downwash. 46 Fed. Reg. at 49,819. This is because the standards measure pollutants after they have dispersed in the air, not in the concentrated doses caused by downwash. *Id.* Also, the standards measure average concentrations over time periods ranging from one hour to one year, which is too long to measure accurately the peak concentrations of downwash pollutant. *Id.* (In this court, EPA states that it is currently reviewing its SO_2 standard to determine whether a short-term standard is necessary to protect public health. Brief of Respondents at 35 n.27.)

Thus, only the forty-percent test was left. In this circumstance, the basis for, and derivation of, that test become especially important.

The forty-percent figure was derived from a review of the scientific literature on stack heights, including reports of wind tunnel tests EPA itself conducted during the rulemaking. EPA discovered a consensus in the literature that "the well established 2.5 times rule" was the stack height necessary to avoid "significant effects" for most buildings. The 1+1.5 Rule was found to be the consensus for tall, thin buildings. *See* Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for Stack Height Regula-

tions) (July 1981), Joint Appendix (J.A.) at 1086 [hereinafter cited as Technical Support Doc.].

EPA then looked to the amount by which ground-level concentrations of pollutant were increased when a 2.5 or 1+1.5 stack was in place. It found that these formulas did not eliminate all effects of downwash but limited increased concentrations to roughly forty to eighty percent over the preexisting concentrations, with eighty percent representing an unusually high amount. *See id.* at 1096. EPA reasoned that if under traditional engineering practice the increase in concentrations was limited to about forty percent, then increases over forty percent could be regarded as excessive. *See* Draft Technical Support Document for Determination of Good Engineering Practice Stack Height (July 31, 1978), J.A. at 42 (Where range of increases recorded at GEP height was 20% to 40%, report concluded that "an increase in maximum concentrations less than 20% is less than expected for GEP stack height while an increase in maximum concentrations greater than 40% is excessive.").

The forty-percent figure is thus the lesson of history: it is what the engineering community has regarded as too much downwash. NRDC and Sierra Club argue that this approach is all wrong, since Congress's real concern in encouraging stack heights high enough to prevent "excessive concentrations" of downwash was the protection of human health. Therefore, they say, EPA must exercise its own independent judgment and define the term to allow enough height to prevent health-threatening downwash, and no more. Because the forty-percent standard is based on a relative value that varies with background concentrations, NRDC and Sierra Club assert, it does not measure the absolute levels of pollutant that are a danger to health.

Our review of the statute and its legislative history discloses sharply conflicting signals on whether Congress intended to legislate the preexisting engineering practice

or only so much stack height as would protect health or welfare. On the one hand, the primary statutory standard was "good engineering practice," suggesting an intent to mandate whatever engineers had been doing. Moreover, the entire purpose of the statute was to remedy an abuse that had arisen whereby polluters were building stacks solely to evade Clean Air Act requirements; Congress may well have wanted to return to whatever engineers would do in the absence of the Act. In addition, the statute explicitly endorsed the standard—the 2.5 Rule—that Congress thought was the traditional engineering practice.

Nevertheless, Congress did not stop there, for it provided a very precise definition of what it regarded as "good engineering practice," suggesting that it did not intend to leave the question of stack heights entirely to professional standards. While the statutory term at the center of that definition, "excessive concentrations," is ambiguous—it could be read as either in excess of the previously recognized standard or in excess of some absolute standard, such as safety—the legislative history points strongly in the direction of a meaning turning on danger to public health. The House committee report describes why downwash can be a problem in the following terms: "When this [downwash] occurs even the plume from a well-controlled source may cause air quality standards (or other requirements) to be violated." HOUSE REPORT, *supra* p. 5, at 93. We think it a strain to refer to the previously recognized standard as a "requirement"; it seems likely that the committee was referring to other legal requirements, such as state nuisance law or the Clean Air Act's prevention of significant deterioration increments.

EPA's 1973 stack height guidelines, which, as we have said, appear to have been Congress's main source for the statutory language, also strongly suggest that the evil sought to be avoided by good engineering practice was

tied to some minimum level of danger or inconvenience to the community. They provided:

> Emissions from stacks which are shorter than required by good engineering practice often can cause excessively high ground level concentrations and nuisances within, and in the immediate vicinity of, the facility. . . . The use of stack height up to the level of good engineering practice is encouraged by EPA in order to avoid local nuisances.

1973 Guidelines, *supra* p. 9, at 25,700; *see also, e.g., Commonwealth v. South Covington & C. St. Ry.*, 181 Ky. 459, 463, 205 S.W. 581, 583 (1918) ("[A] common or public nuisance is the doing of or failure to do something that injuriously affects the safety, health, or morals of the public, or works some substantial annoyance, inconvenience, or injury to the public . . . ."); *United States v. County Board*, 487 F. Supp. 137, 143 (E.D. Va. 1979) ("The term 'nuisance' . . . includes everything that endangers life or health, gives offense to the senses, violates the laws of decency, or obstructs the reasonable and comfortable use of property.").

What seems most likely is that Congress thought traditional engineering practice and protection of health were the same thing. If that is the case, however, what are we to do if it develops, as NRDC and Sierra Club argue, that traditional engineering practice in fact dictates a height that is in some cases much higher than necessary to protect human health? We are saved from the full rigors of this potential conundrum by the conference committee. Its report states:

> [I]f it should be determined that downwash, eddies, and wakes can be prevented by stacks of less than 2½ times facility height, the Administrator's rule should give 'credit' only for the height needed to avoid these conditions.
>
> . . . In other words, it was not our purpose to make a Congressional judgment about what stack

> height was needed to prevent downwash. We intend EPA to make this judgment, subject only to the Congressional prohibition on the excessively high stacks of over 2½ times building height.

123 CONG. REC. 27,071 (1977).

What this passage suggests is that Congress wanted the Administrator to determine the height necessary to avoid excessive concentrations of downwash-caused pollution. Since Congress believed that the 2.5 Rule was in fact the good engineering practice rule, *see* HOUSE REPORT, *supra* p. 5, at 93 ("A stack height value produced by reference to this historical relationship is referred to as 'good engineering practice' stack height and has been used by EPA in its regulations."), the passage suggests that the conference committee saw the possibility of a distinction between its definition of the amount of downwash to be avoided and what engineers had been doing. If that turned out to be the case, the committee was clear that the statute's definition would govern. Thus, development of a standard governing the height of stacks by reference *solely* to what engineers had been doing, with no regard for some real life values, was contrary to the intent of Congress.

Reading the House committee report as a whole confirms this view. It begins its discussion of the details of the bill with the observation that downwash is a problem because it causes air quality standards or other requirements to be violated, and only then discusses the "historically . . . responsible way of dealing with the problem." *Id.* This suggests that meeting air quality standards was primary in its mind and that good engineering practice was merely a way to do so.

Finally, we are considerably bolstered in our view that Congress was thinking primarily of dangers to health because that was the position originally taken by the Administrator. In the 1979 proposed regulations, primary re-

liance was placed on the requirement that the downwash in question cause a violation of air quality standards. The forty-percent proviso was merely intended, EPA wrote, "to establish a reasonable upper bound for creditable stack heights." 44 Fed. Reg. at 2611.

When EPA dropped the air quality standards as one of its criteria for measuring "excessive," it did not address whether the forty-percent test measured danger to health or welfare. Neither EPA nor the utilities that have intervened on its behalf have disputed the contention of Sierra Club and NRDC that the forty-percent rule, because it measures relative changes in "preexisting concentration," cannot measure the absolute levels of pollutant that are a danger to health. *See* Brief of Petitioners at 39. We agree that the level of pollutant that is a danger to health is an absolute value: the Act clearly envisions that the national ambient air quality standards that are to protect health and welfare will be defined in terms of maximum concentrations of each pollutant, *see, e.g.*, 42 U.S.C. § 7409(c) (1976) (requiring promulgation of standard for "NO_2 concentrations over a period of not more than 3 hours"), and that is the way the Administrator has consistently implemented the Act, *see, e.g., American Petroleum Institute v. Costle*, 665 F.2d 1176 (D.C. Cir. 1981) (approving ozone standard of 0.12 parts per million), *cert. denied*, 455 U.S. 1034 (1982).

We disagree, however, with the petitioners' interpretation of the present regulation, and thus with their conclusion regarding the relation of the regulation to health. NRDC and Sierra Club appear to assume that the forty-percent increase in concentration is to be an increase over the preexisting levels in the area including background concentrations of pollutants. We believe, however, that the increase is to be measured against the amount of the source's own plume that falls to the ground even without downwash, regardless of preexisting or background concentrations of pollutant from other sources.

Petitioners' interpretation is arguably the most natural reading of the language of the regulation itself, which is as follows:

> "Excessive concentrations" for the purpose of determining good engineering practice stack height in a fluid model or field study means a maximum concentration due to downwash, wakes, or eddy effects produced by structures or terrain features which is at least 40 percent in excess of the maximum concentration experienced in the absence of such downwash, wakes, or eddy effects.

47 Fed. Reg. at 5869 (to be codified at 40 C.F.R. § 51.1(kk)). The regulation does not specify whether the "maximum concentration experienced in the absence of such downwash" is to be measured with or without pollutants generated by other sources. The 1979 proposal was similarly ambiguous. *See* 44 Fed. Reg. at 2614 (maximum concentrations "due in part or whole to downwash, wakes, or eddy effects").

The preamble to the final regulations, however, is explicit that the forty-percent standard requires the source to demonstrate that "maximum concentrations *caused by the source's emissions from its proposed stack height*, without consideration of nearby structures or terrain obstacles, will increase by at least 40 percent when the effects of the structures or terrain obstacles are considered." 47 Fed. Reg. at 5865 (emphasis added). Even more important, we see no reason why, as a scientific matter, one would rationally include background concentrations in the calculation.

Although this court's knowledge of the operation of downwash is admittedly rudimentary, it seems most likely that the amount of additional pollutant that is brought to the earth by means of downwash will somehow relate to the amount of the original fallout, either because fallout is a process similar to downwash and therefore pro-

duces proportionate amounts of grounded pollutants, or because both relate proportionately to the density of the plume. Presumably, therefore, the amount of a plume that falls to earth near the plant even in the absence of downwash is either an absolute number for all plumes emitted at a certain height or, more likely, varies with the density of the plume. Conversely, it seems unlikely that the amount of downwashed pollutant from a given stack height should vary with background concentrations of that pollutant in the area. That would mean that the eddies and whirlpools that bring the plume down to earth would operate more effectively the dirtier the surrounding air becomes, which, even if possible, seems odd. We conclude, therefore, that the forty-percent increase refers to an increase in the amount of pollutants from the plume that fall to the ground regardless of atmospheric conditions.

We have not had any argument on whether the regulation, so interpreted, in fact estimates dangers to health and welfare. On the one hand, it seems likely that it was such dangers to health and welfare that traditional engineering practice, from which the forty-percent figure was derived, sought to prevent, at least in a very rough way. On the other hand, EPA has not made this argument, relying instead on congressional approval of good engineering practice per se. In addition, the EPA scientists who derived the forty-percent figure did not describe it as an accurate measure of danger to health or welfare. It was rather a measure of what scientists conducting wind tunnel experiments in the past had thought was "a significant concentration difference" as they observed the smoke pouring out of their model smokestacks. *See* Technical Support Doc., *supra* p. 20, at 1092. The EPA scientists cautioned:

> *The visualized . . . studies can be strongly biased by the observer's eye and are extremely sensitive to the density of the smoke. The information from concen-*

> *tration profiles is influenced strongly by* where the traverse through the plume is made [to determine the plume centerline] and *the judgment in determining what constitutes a significant concentration difference. . . .*
>
> . . . Although the consensus opinion in the scientific literature strongly supports using [the 1+1.5 Rule] to determine GEP stack height, *actual studies could show the need for a much taller or lower stack depending on one's interpretation of what is a significant influence* and on the effect of possible plume rise.

Id. at 1089-92 (emphasis added).

Moreover, we note that EPA chose the forty-percent figure from a range of increased concentrations produced by a stack 2.5 times the height of the obstacle, and forty percent was at the low end of that spectrum. The choice of forty percent as the definition of "excessive" is more consistent with an attempt to arrive at a reasonable upper limit on stack height—i.e., to place a floor on the amount of increased concentration that would justify an increased stack height—rather than an attempt to discern the historical concept of safe levels of downwash. Reliance on the lower figure alone also does not appear to be consistent with the clearly expressed congressional expectation that credit for stacks in excess of the 2.5 Rule would "be highly infrequent and that the latitude given the Administrator to allow full credit for such stack height [would] be exercised with circumspection and utmost caution in those rare circumstances proven to justify its use," HOUSE REPORT, *supra* p. 5, at 93.

Finally, apart from the intention of EPA in developing the forty-percent rule, we think it unlikely that even the reinterpreted present rule will measure an absolute pollutant concentration that is dangerous to health, rather than a range of concentration increases varying with the density of the plume and other factors. Of course, it may

be that, for all stacks large enough to be of concern, that range of increases will be entirely above the threshold of danger to health or welfare. EPA has not said so, however, and our examination of the derivation of the figure suggests strongly that that is not the case.

We think our best course is to remand the definition of "excessive concentrations" to the Administrator with instructions to develop a standard directly responsive to the concern for health and welfare that motivated Congress to establish the downwash exception. We do not condemn the historical approach EPA has taken to deriving that standard, but we caution EPA to be aware that it is writing under substantially different conditions from those that faced the engineers who first developed the rules of thumb for stack height. The engineers could be satisfied with a conservative rule that was absolutely sure to eliminate health hazards, but only local ones; EPA must be more stringent, since any extra height will mean increased emissions and longer transport of pollutants, both of which Congress has instructed the agency to minimize. Therefore, EPA must satisfy itself in some way independent of history that the standard it derives in fact fairly approximates the stack height level needed to protect local health and welfare; in doing so, moreover, it should err on the side of reducing stack height, in keeping with Congress's command that credit for stack heights above the 2.5 Rule height be granted with "utmost caution." These two precepts are the heart of our holding on this issue.

C. *Failure to Consider Plume Rise*

Plume rise refers to the tendency of exhaust gases to continue to rise after they leave the stack because of their momentum and heat. Petitioners NRDC and Sierra Club assert that in deriving the 1+1.5 and 2.5 Rules EPA has ignored plume rise. They argue that the failure to consider plume rise is arbitrary and capricious, because it

will lead to the prediction of excessive concentrations where none will occur since the "effective" height of the stack will be much higher than the physical height. Thus, they say, the GEP formulas will allow higher GEP height than needed to ensure against excessive concentrations of pollutant caused by downwash.

EPA admits that the formula does not take account of plume rise, but asserts that "[u]nder the very high wind conditions that cause downwash, no plume rise takes place near the source." Summary of Comments and Responses on the October 7, 1981 Proposal of the Stack Height Regulations (Dec. 1981), J.A. at 1190 [hereinafter cited as 1981 Responses]; *accord* Technical Support Doc., *supra* p. 20, at 1102 ("[T]he critical conditions for determining GEP stack height for most sources are considered likely to be high winds associated with neutral atmospheric stability with little plume rise near the sources."); *see also* 46 Fed. Reg. at 49,820 ("[T]he comments correctly pointed out that the technical support document was based on studies which did not include plume rise.").

NRDC and Sierra Club dispute this factual conclusion, citing two pieces of evidence. First, they point out that EPA's own regulations for running the demonstrations that operators may use to gain above-formula height require the inclusion of plume rise. *See* 46 Fed. Reg. at 49,820 ("Fluid models and field studies take into account gas flow rates and temperature, in addition to stack height. Accordingly, they will take into account some plume rise in establishing the GEP stack height."); Draft Guideline for Use of Fluid Modeling to Determine Good Engineering Practice Stack Height (June 1979), J.A. at 677-78, 680 [hereinafter cited as Fluid Modeling Guideline]. Second, they cite a report submitted by the Tennessee Valley Authority in this rulemaking that estimates the plume rise above the top of the stack during strong winds to be 99, 84, and 145 meters at 76, 91, and

305 meter stacks, respectively. *See* An Analysis of Terrain-Induced Aerodynamic Disturbances Near the Kingston Steam Plant, Kingston, Tennessee, at 1-1, Record at 77 app.

We view this as a factual dispute that we must review under the substantial evidence standard, *see* 5 U.S.C. § 706(2)(E) (1976). We side with EPA. Its conclusion that plume rise is not significant rests primarily on the wind tunnel studies cited in its technical support document, which did not provide for plume rise, yet derived approximately the same formula as apparently had arisen as "a practical formula" from years of empirical observation, presumably including any plume rise. *Compare* Technical Support Doc., *supra* p. 20, at 1080 ("This rule arose during the early part of this century as a practical formula. [A 1955 study] report[s] that the rule had been successfully used by the British electricity generating industry during the previous 20 years.") *with id.* at 1086 ("A review and evaluation of the current literature . . . reveals a consensus that [the 2.5 Rule is] the stack height necessary to avoid significant effects for buildings whose projected width is greater than its height. . . . [Otherwise, the 1+1.5 Rule is appropriate.]"). Since studies that do not account for plume rise arrived at the same conclusion that was derived from observations including plume rise, it seems fair to infer that at least the usual amount of plume rise does not have a significant effect on downwash. In response to concerns about the possibility of artificially increasing plume rise beyond the normal amount, EPA's regulations prohibit as a dispersion technique installation of fans and heaters intended to enhance plume rise. *See* 47 Fed. Reg. at 5868 (to be codified at 40 C.F.R. § 51.1(hh)); *id.* at 5867; 46 Fed. Reg. at 49,820; *infra* pp. 50-57.

That EPA has allowed operators to account for plume rise in demonstrations does not persuade us that the

1+1.5 Rule is unprincipled, because we think it entirely rational for EPA to be more concerned that even small amounts of plume rise be accounted for when a source is seeking greater height than provided by the formulas. Congress specifically directed that such increased height be allowed only "with circumspection and utmost caution in those rare circumstances proven to justify its use." HOUSE REPORT, *supra* p. 5, at 93. (The report was referring to heights in excess of the 2.5 Rule, but we think it clear that its thinking applies equally to the more accurate 1+1.5 Rule.) The formulas, on the other hand, are intended to be easy to apply and, of necessity, somewhat rough rules of thumb. We think such a dual approach was within the contemplation of Congress and is not a capricious use of EPA's limited resources.

Petitioners' citation of the significant plume rise reported in the TVA study does not substantially undermine EPA's assertion that plume rise is fairly insignificant under downwash conditions. The TVA report does not contradict EPA's finding that, particularly as wind speed increases, plume rise near the stack, where downwash occurs, is generally small even though plume rise further downwind may be significant. Such a phenomenon is an expected consequence of high wind conditions, and it is consistent with EPA's view that plume rise has little effect on downwash near the stack. *See* Fluid Modeling Guideline, *supra* p. 29, at 666 ("Under such conditions [high wind speed and neutral stability], plume rise near the source where its rise is dominated by momentum flux, will be small while its rise farther downwind may be largely due to buoyancy [heat] flux.").

We affirm the refusal to include plume rise in the derivation of the formulas.

D. *Inclusion of Plume Impaction*

Plume impaction occurs when a plume of exhaust gases emitted from a stack hits a higher hill or mountain down-

wind of the stack. Under stable atmospheric conditions, the plume can hit the mountain before it has dispersed, causing high concentrations on the mountainside. *See* 1981 Responses, *supra* p. 29, at 1166.

In response to comments received after its 1979 proposed regulations, EPA decided to allow credit for stack heights needed to avoid violation of national air quality standards on the elevated terrain. *See* 46 Fed. Reg. at 49,815-16. The new regulations allow a source to receive credit for the amount of its stack necessary to ensure that violations will not occur on the mountain as a result of the amount of the mountain's height that is above GEP height. 47 Fed. Reg. at 5869 (to be codified at 40 C.F.R. § 51.12(*l*)).[4] Without plume impaction credit, the

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[4] The operation of the plume impaction credit is difficult to explain but, ultimately, ingeniously simple in conception. Three steps are involved. *See* 47 Fed. Reg. at 5867.

First, the GEP stack height is calculated with regard to downwash-causing obstacles. If a violation of air quality standards is predicted by reason of the plume hitting a mountain higher than GEP height, then the source may go to the second step. If no violation is modeled, then the source cannot claim impaction credit.

Second, an emission limitation is set by imagining that the mountain is as tall as the GEP stack height calculated in step one. Thus, it is assumed that the mountain is short enough to permit the GEP stack height to throw the plume over the mountain, and an emissions limitation is set so that no violation will occur on the truncated mountain.

The third step allows the source to raise its stack up to the level at which no violation will occur on the actual mountain. The emission limitation remains at the amount set in step two. That is, the source will receive credit for the height of the stack necessary to throw the plume over the mountain.

The impaction credit will result in a considerably higher emissions limitation than would be permitted if the source had to model its emissions at the original GEP height so as to avoid violations on the mountain. If carefully administered—e.g., if the emissions limitation required in step two reduces

source would have to reduce its emissions to prevent modeled violations on the mountainside.

Petitioners NRDC and Sierra Club argue that section 123 does not permit EPA to give credit for stack height necessary to avoid any phenomena other than "downwash, eddies and wakes," and that plume impaction is not one of these statutorily specified exemptions. Plume impaction is caused by obstacles downwind of the stack, rather than upwind of it, and generally occurs when there is little wind to disperse the plume, rather than when the wind is strong.

EPA admits that plume impaction is not the same as downwash, eddies, or wakes, but argues that they are sufficiently similar that the same rationale should apply to it. 47 Fed. Reg. at 5866 ("In all of these events, structures or terrain features interfere with plume dispersion."); 1981 Responses, *supra* p. 29, at 1167-68 ("These conditions are similar but independent of each other since they generally occur under different meteorological conditions."). The agency relies on its general authority under section 301 of the Act to "prescribe such regulations as are necessary to carry out [its] functions under [the Act]." 42 U.S.C. § 7601(a)(1) (Supp. V 1981).

EPA's construction of the statute is condemned by the general rule that when a statute lists several specific exceptions to the general purpose, others should not be implied. *See, e.g., A.H. Phillips, Inc. v. Walling*, 324 U.S. 490, 493 (1945) ("Any exemption from such humanitarian and remedial legislation must . . . be nar-

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emissions to precisely the amount needed to avoid violations on the truncated mountain and no lower—the credit will, however, give the source an emissions limitation no higher than it would give a similar utility located in flat terrain. The result of the impaction credit will only be to allow the mountain utility, as compared to a source in flat terrain, to disperse the same or a lower amount of emissions over wider territory.

rowly construed . . . ."); *Colorado Public Interest Research Group, Inc. v. Train*, 507 F.2d 743, 747 (10th Cir. 1974) ("[W]here the legislature has acted to except certain categories from the operation of a particular law, it is to be presumed that the legislature in its exceptions intended to go only as far as it did, and that additional exceptions are not warranted.").

Had we any doubts that this rule should apply to this case, they are eliminated by the specific instruction in the House committee report that the term "nearby" should be "strictly construed, in keeping with the general policy of statutory interpretation favoring strict construction of exceptions and variances." HOUSE REPORT, *supra* p. 5, at 93; *see also supra* pp. 15-18 (discussion of meaning of "nearby"). Not only the word "nearby," but the entire permission to give credit for "good engineering practice" height constitute exceptions or variances. Congress sought to prohibit reliance on stack height to achieve air quality standards except in certain cases that it very specifically defined. The specified cases are where stack height is needed to prevent excessive concentrations resulting from "downwash, eddies and wakes." We should be extremely chary of adding any others.

EPA argues, however, that this rule should be softened when it appears that Congress was not informed of the problem and therefore did not deliberately omit it. EPA asserts that this is such a case. *See* 47 Fed. Reg. at 5866 ("Section 123 does not mention impaction. However, neither the language of the statute nor the legislative history show that this omission was deliberate."). We agree that where there is evidence that Congress considered or was informed of other things of more or less the same species as the ones placed in the statute, the case is stronger for inferring that the others were deliberately excluded. *See Lubrizol Corp. v. EPA*, 562 F.2d 807, 817-18 (D.C. Cir. 1977) (fact that hearing witness listed

several factors, including fuel and fuel additives, that affect automobile emissions suggests that at least some members of Congress did not expect statutory term "fuel" and "fuel additives" to include other potential causes of pollution, such as motor oil). We conclude, however, that the obverse rule advanced by EPA—that if there is no evidence that Congress knew of or considered the other things, the presumption should be that they are included in the statutory exception—would be contrary to the strict construction of exceptions directed by judicial doctrine and by the legislative history of this law. *Cf. Harrison v. PPG Industries*, 446 U.S. 578, 592 (1980) ("[I]t would be a strange canon of statutory construction that would require Congress to state in committee reports or elsewhere in its deliberations that which is obvious on the face of a statute.").

In any case, there is some evidence in the legislative history of the 1977 amendments that Congress was in fact made aware of the problem of plume impaction in hilly terrain. Representatives of electric utilities appeared before the congressional subcommittees considering the amendments and discussed the deleterious effects the new laws would have on utilities. They contended that several provisions in combination would limit the availability of plant sites in mountain areas. Among the provisions mentioned were those that sought to prevent the deterioration of clean-air areas, called prevention of significant deterioration (PSD) provisions, and the tall stacks section. Thus, a representative of the Edison Electric Institute, the principal national association of investor-owned electric companies, reported the following adverse effect of the amendments:

> (2) More coal-fired power plants would have to be built in the mid-west and in eastern coastal plains and less in the Appalachians and the West because of the substantial penalties imposed on plant size by [PSD] and tall stack limits in areas of hilly terrain.

Clean Air Act Amendments of 1977: Hearing on S. 251, S. 252, and S. 253 Before the Subcomm. on Environmental Pollution of the Senate Comm. on Environment and Public Works, 95th Cong., 1st Sess. (pt. 2), at 231 (1977) (written testimony of Donald G. Allen).

Moreover, these limitations on siting were linked specifically to plume impaction by the testimony of E. Allan Hunter, president of the Utah Power & Light Co., before the same subcommittee. Mr. Hunter proposed a variance procedure for allowing certain plants to exceed the relevant PSD limitations for five percent of the year to account for those days on which plume impaction might occur:

> Our problem lies in the nature of the topography out in Utah. Utah consists of narrow valleys, with mountainous or hilly terrain on either side. The mountainous terrain models [that] are now being used to predict pollutant concentrations indicate that perhaps a few days in the year under stagnant air conditions the SO_2 concentration on the adjacent hillsides would exceed the allowable limits.

Id. at 37 (oral testimony); *see also id.* at 337 (written statement of Mr. Hunter) ("What we here urge is an alternative that would facilitate good plant siting . . . ."); *id.* at 339 (same) ("This material [certain studies] does indicate that without . . . some relief from the short term plume impact on high terrain . . . , we cannot build sufficient capacity to supply the electric needs of our customers in the next twenty years."). Although these complaints were heard and became part of the congressional debate on the amendments, *see, e.g.*, 122 CONG. REC. 34,405 (1976) (remarks of Sen. Tower, opponent of the amendments) ("Studies by electric utility consultants concluded [that under PSD provision] only small, inefficient and uneconomical powerplants could be built in hilly terrain . . . ."); *infra* pp. 42-44, neither Mr. Hunter's proposal nor any other relief for mountainous areas was enacted in response.

Thus, although no one made explicit the link advanced in the regulations between taller stacks and plume impaction, these excerpts suggest that at least some members of Congress were aware that (1) requiring short stacks would somehow tend to preclude certain potential sites for power plants in hilly terrain, and (2) plume impaction was one reason that fewer such power plant sites would be available. It may be too much of a leap to say that Congress understood that taller stacks might help to reduce the effect of plume impaction, and rejected such an approach. But we think we may infer at least that the problems created by plume impaction and by requiring short stacks in hilly terrain were brought to Congress's attention, and Congress chose not to focus on, and resolve, them. This suggests a relative indifference to the problem of nearby mountains causing very stringent emissions limitations, an indifference that is at odds with the willingness to avoid the strict limitations that would be required because of downwash, eddies, and wakes, were it not for section 123.

Little more need be said to refute the argument raised in this court by a number of utility intervenors that excluding plume impaction from the calculation of emission limitations would result in much stricter limitations for utilities located in mountainous terrain than for ones located in the flatlands. Since this would mean a decline in jobs and industrial activity in mountain regions, the utilities argue, EPA has properly construed section 123 in light of the purpose stated in section 101 of the Act "to protect and enhance the quality of the Nation's air resources *so as to promote the public health and welfare and the productive capacity of its population.*" 42 U.S.C. § 7401(b)(1) (1976) (emphasis added).

In enacting section 123, Congress clearly did not intend to legislate geographic equality. In fact, it specifically expected that the tall stacks provision would have a disproportionately heavy impact on polluters in moun-

tain areas. Thus, the House committee report noted the committee's "expectation" that "persons responsible for citing new facilities will not locate them next to terrain features which will produce . . . downwash." HOUSE REPORT, *supra* p. 5, at 93. Moreover, it quotes EPA Administrator Douglas Costle's statement that the Administration thought it " 'clearly preferable to require tighter controls or *more careful siting* to solve our air quality problems rather than disperse pollutants over greater distances.' " *Id.* at 92 (emphasis added). In his testimony, Mr. Costle went on to state, "If we later learn that tall stacks are essential for siting certain types of facilities, we would consider asking Congress for authority to allow tall stacks for such facilities in cases where public health would not be affected." *Clean Air Act Amendments of 1977: Hearings on H.R. 4151 & H.R. 4758 Before the Subcomm. on Health & the Environment of the House Comm. on Interstate & Foreign Commerce*, 95th Cong., 1st Sess. (pt. 2), at 1679 (1977).

Thus, we do not think section 123 permits EPA to take plume impaction into account in setting the degree of emission limitation required for sources in hilly areas. EPA's reliance on its general authority to make rules necessary to carry out its "functions" does not avail it, because, as we pointed out in *Lubrizol Corp. v. EPA*, 562 F.2d 807, 815 n.20 (D.C. Cir. 1977), a specific statutory directive "defines the relevant 'functions' of EPA," so that section 123 is the sole source of statutory authority.

We admit that there is much to commend EPA's action from a policy perspective. Without EPA's plume impaction provisions, the law discriminates harshly against utilities located in mountainous terrain, for it will require them to emit far less than their flatland counterparts. The only cost of allowing EPA to mitigate that discrimination by bringing flatland and mountain emissions limitations closer together would be that moun-

tain utilities would have to disperse their pollutants more widely. *See supra* note 4.

We note, however, that Congress viewed tall stacks as a problem not only because they did not decrease the loading of emissions into the air, but also, and independently, because they served to disperse pollutants more widely. Wide dispersion had been linked to the formation of acid rain, tended to export pollution to previously pristine areas, and made enforcement more difficult because of the difficulty of tracing dispersed pollutants back to their source. *See* HOUSE REPORT, *supra* p. 5, at 83-87; *see also* An Assessment of the Potential Effect of Stack Height on Sulfate Formation and Sulfur Deposition (December 1979), J.A. at 791 ("Tall stacks allow more sulfate formation and less [sulfur] removal than an equivalent release at lower heights . . . ."). Of course, such wider dispersion is permitted anyway by the Act, *see* 42 U.S.C. § 7423(c) (1976) (EPA may not restrict in any manner the actual stack height of any source), but the plume impaction rules would encourage or, effectively, require it. It is conceivable that Congress would decline to encourage the very tall stacks no doubt needed to overcome plume impaction in mountainous terrain. Thus, the construction we place on the statute is harsh, but not utterly irrational, and therefore we are constrained to give the statutory exception the strict interpretation that Congress specifically intended.

EPA's attempt to reduce emissions limitations by so much of the stack height as needed to avoid plume impaction is reversed.

E. *Requiring Demonstrations only for Stacks Above Formula Height*

Under EPA's regulations, a source concerned about downwash caused by buildings must use a demonstration, as opposed to the simpler and cheaper formulas, only when it seeks credit for stack height in excess of that

provided by the formulas. Petitioners Sierra Club and NRDC assert that it was an abuse of discretion for EPA not to require demonstrations in two other cases: (1) whenever local or federal pollution authorities believed the formulas overestimated the height needed to prevent excessive concentrations of downwash-caused pollution, and (2) whenever a facility sought to raise an existing stack. The latter argument is based on the theory that stacks have historically been built to avoid downwash, so that there is a presumption that existing height is sufficient.

The first of these provisions was included in the 1979 proposed regulations, and the second—regarding existing stacks—was mentioned then as a specific case in which demonstrations might be required in particular instances. 44 Fed. Reg. at 2614; *see id.* at 2610. In 1980, in connection with a request for approval of credit for stack height increases at two existing power plants in Ohio, EPA decided to require demonstrations in all cases where a source sought to raise an existing stack height. 45 Fed. Reg. 42,279, 42,281-82 (1980). The agency explained that it had become increasingly concerned that current emissions levels were "resulting in significant regional air pollution problems, particularly acid rain." *Id.* at 42,281.

> Since publication of EPA's [1979] proposal, several sources have requested relaxations of SO_2 emission limitations in connection with stack height increases up to the height permitted by the GEP formula. EPA is concerned that allowing sources automatic credit for GEP formula height is improperly encouraging emission limit relaxations and SO_2 emission increases that aggravate the acid rain problem.

Id. At the time, EPA expected to incorporate the existing-stacks requirement into final stack-height regulations within a few months; a year later, when the final rules still had not been issued, EPA withdrew the requirement

pending consideration of the final rules. 46 Fed. Reg. 28,650 (1981).

Neither the 1981 reproposed regulations nor the final regulations under review contain either provision. EPA gave three reasons for the changes. First, it expressed great faith in the formula as an accurate measure of GEP height. In the 1981 reproposal, for example, EPA stated, "[W]e have established that the formula is the best determination of good engineering practice stack height based on nearby structures." 46 Fed. Reg. at 49,820; *see also* 1981 Responses, *supra* p. 29, at 1172 ("[A]fter reviewing the facts and information available, EPA believes that the formula provides a very good estimate of the stack height necessary to avoid excessive concentrations caused by downwash.").

Second, evidently as to the proposal that local authorities be allowed to require demonstrations for below-formula stack heights, EPA asserted that "inconsistencies could result." 46 Fed. Reg. at 49,820. This comment is cryptic, but we suspect that it must refer to inconsistencies between lax and zealous state environmental protection agencies, resulting in different requirements for similarly situated plants in different states.

Third, EPA cited a passage from the House committee report that it says indicates an intent to allow automatic credit up to formula height. 1981 Responses, *supra* p. 29, at 1173. The passage is from the report's discussion of the PSD provisions, in which the committee argues that those provisions will allow sufficient industrial development in all but the cleanest areas. HOUSE REPORT, *supra* p. 5, at 159-64. The report adds:

> The committee bill even allows credit for stack height up to 2½ times the basic height of the structure. This means that the average new coal-fired powerplant could have stacks as tall as 500 feet. (*Older plants would be permitted to increase existing*

stack heights up to 2½ times, or more in some cases under the bill.)

Id. at 162 (emphasis added).[8]

This last reason is easily neutralized. We agree that the House committee, and perhaps the Congress generally,

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[8] EPA also suggested that the 1980 decision to require demonstrations for all increases of existing stacks was intended as a response to a temporary problem, rather than a permanent solution. It explained the decision as follows: "In June 1980, faced with the requirement to approve or disapprove State Implementation Plan revisions for two Ohio power plants and still in the process of evaluating its policy on increase [sic] stack heights at existing facilities, EPA established as stringent a policy as possible to handle the issue." 1981 Responses, *supra* p. 29, at 1172.

We note that EPA has at times attributed a good deal more permanence to its 1980 decision than it now does. *See* 46 Fed. Reg. 28,650, 28,650 (1981) (withdrawing the policy) ("At that time, EPA expected to publish final stack height regulations incorporating the revised policy within a few months."); 46 Fed. Reg. 8581, 8582 (1981) (allowing comment on what it termed "the June 1980, final rulemaking"). *But see id.* ("EPA decided to modify its [1979] stack height *proposal.*") (emphasis added). Nevertheless, we realize that EPA issued the new policy without public comment and hurriedly, in order to comply with a commitment it had made to an appeals court in litigation over the agency's relaxation of a compliance date for the Ohio plants' emissions limitation. *See id.* at 8581. Thus different pressures were acting on the agency than when it promulgated the rules under review, so it might well have decided to err on the side of pollution control. We thus do not give any great weight in our current review to the fact that the 1980 decision was actually implemented as opposed to merely proposed. *See generally* Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 51 U.S.L.W. 4953, 4956 (U.S. June 24, 1983) ("an agency changing its course by rescinding a rule is obligated to supply a reasoned analysis for the change beyond that which may be required when an agency does not act in the first instance"). In either case, EPA must at least explain its rejection of alternatives with reasons that are not contradicted by the record. We hold that it has not done so here.

probably had in mind a system of determining GEP stack height involving a generalized formula applicable to all sources except those seeking greater height. This appears to have been the general conception of the 1973 guidelines upon which Congress drew in drafting section 123, *see* 1973 Guidelines, *supra* p. 9, at 25,700 (2.5 Rule produces proper height in "fairly level terrain," but "[f]or more complex situations, . . . detailed engineering and meteorological investigations . . . should be conducted to determine the appropriate stack height"), and the House report's discussion of section 123 itself seems to make the same assumption, *see* HOUSE REPORT, *supra* p. 5, at 93 ("affirming the 2½ times standard" but recognizing need to approve greater height when "aerodynamics of a source" require it).

Nevertheless, the statute itself is carefully designed to commit the determination of GEP height to "regulations promulgated by the Administrator" and speaks of the 2.5 Rule only as an upper limit. The conference committee's report even more clearly evinces an intent to leave the entire question of what method to use to determine GEP height to the discretion of the Administrator (subject to the requirement of demonstrations for any height above 2½ times the height of the source). The conference committee explicitly stated that the Administrator's rule "should give 'credit' only for the height needed to avoid" the downwash problem, and suggested that that rule might differentiate among various kinds of sources if it was found that the height needed to avoid downwash so varied. The report concluded, "In other words, it was not our purpose to make a Congressional judgment about what stack height was needed to prevent downwash. We intend EPA to make this judgment . . . ." 123 CONG. REC. 27,071 (1977). The report does not depart from the expectation that GEP height will usually be determined by a formula, but it does make clear that the formula used is up to the Administrator. Implicit in that discretion is the power to decide when the formula must be

used. Therefore, our review here is not of an interpretation of specific congressional intent, but rather of the agency's exercise of its discretion.

In evaluating whether EPA acted arbitrarily and capriciously in rejecting the two additional uses of demonstrations it initially proposed, we are left, then, with two explanations: an expressed belief in the accuracy of the formulas, and a fear of inconsistent enforcement. *See generally SEC v. Chenery Corp.*, 332 U.S. 194, 196 (1947) (agency action must be judged solely on the grounds invoked by the agency). Of the two explanations, the central reason must be EPA's confidence that the formulas provide "a very good estimate of the stack height necessary to avoid excessive concentrations caused by downwash," 1981 Responses, *supra* p. 29, at 1172, for if EPA had less confidence in the formulas, its view of how much inconsistency in state enforcement it could tolerate would surely change.

EPA's confidence in the formulas developed under the agency's apparent view that "excessive" meant an amount over the amount permitted by traditional engineering practice. We have found this to be an inadequate definition of the term, however, because Congress intended the agency to arrive at an independent conclusion regarding the stack height needed to prevent dangers to health and welfare resulting from downwash. *See supra* pp. 18-28. The words "excessive concentrations," from which we derived this requirement, govern not just demonstrations, but the Administrator's determination of "good engineering practice" generally. EPA therefore has not properly addressed the question of whether the formulas provide an accurate enough measure of the amount of stack height needed to avoid dangers to health and welfare. *See, e.g.*, Technical Support Doc., *supra* p. 20, at 1092 (degree to which 1+1.5 formula height that would be dictated by "actual studies" depends on "one's interpretation of what is a significant influence" on ground concen-

trations). We must remand for the agency to consider how well the formulas protect against excessive concentrations and thus whether they are so accurate that demonstrations need not be used to justify raising stack heights in the two circumstances noted at the outset.

The Administrator's second justification for the present rule is also deficient, and we therefore caution him that should he again propose the disparate use of demonstrations, he must rely on something other than bald assertions about inconsistency of enforcement. We are not in a position to say whether a well-grounded fear of inconsistent state enforcement might conceivably justify not providing states with discretion to require demonstrations. We are certain, however, that it will not do for EPA merely to assert that "inconsistencies could result." Inconsistencies will always result from a regulatory scheme that relies on some measure of state enforcement, but the Act clearly envisions state implementation of generalized directives from EPA. *See, e.g.*, 42 U.S.C. § 7407(a) (Supp. V 1981) ("Each State shall have the primary responsibility for assuring air quality within the entire geographic area comprising such State . . . ."); *see also Train v. NRDC*, 421 U.S. 60, 68-70 (1975) (discussing various states' approaches to implementing 1970 amendments to Act). At the least, EPA must specify why it is that such "inconsistency" is especially likely and harmful in this case, and that inconsistency must be weighed against the harms to flow from allowing widespread overestimation of stack heights to go uncorrected.

We note two other considerations that were clearly absent from EPA's initial determination of the amount to which demonstrations were to be used and that should be considered pursuant to our remand. First, there is virtually no evidence in the record supporting a conclusion that the formulas err only in one direction. Although a number of commentators suggested that the 2.5 Rule was regarded as yielding a minimum height necessary to avoid

downwash, *see* J.A. at 142-43 (comments of Rohm & Haas Co.); *id.* at 339 (comments of The Southern Co.), the data discussed by EPA scientists in their review of the literature suggest no such bias. Some of the data in fact suggest that the formulas overestimate the necessary stack height in some circumstances, while virtually no data indicates that they underestimate it. *See* Technical Support Doc., *supra* p. 20, at 1087 ("The extent of significant effects for rounded structures are likely not as great as those for sharp-edged structures, although there is very little information available."); *see also id.* at 1083 (downwash less at rounded-edged than at sharp-edged structures). The conclusion of EPA was that while there was a consensus around the 1+1.5 Rule, "actual studies could show the need for a much taller or lower stack depending on one's interpretation of what is a significant influence and on the effect of possible plume rise." *Id.* at 1092.

In this light, EPA cannot use the inaccuracy in the formulas to allow demonstrations to obtain credit for height above that provided by the formulas but not to limit credit below it. Rationality demands that if the inaccuracy is neutral, the corrective device must be neutral. The statute does not command otherwise. The provision for demonstrations for above-formula height does not require the Administrator to provide for such demonstrations if he believes they are unnecessary. That provision is part of the definition of good engineering practice height, 42 U.S.C. § 7423(c) (Supp. V 1981), the determination of which the statute leaves to the Administrator's discretion, *see id.* § 7423(a)(1). The House committee report leaves no doubt that the provision for demonstrations was a discretionary power, not a command. HOUSE REPORT, *supra* p. 5, at 93 ("In such instances, the Administrator has been given discretion to approve a State implementation plan which provides for stack height greater than the 2½ times standard.").

Second, EPA appears to have radically undervalued the presumption raised by the fact that an existing stack was built to less-than-formula height. The House committee recognized that "for many years, good air quality management has meant building a stack sufficiently tall to offset aerodynamic downwash created by structures in the immediate vicinity of the stack." HOUSE REPORT, *supra* p. 5, at 93. It seems fair and logical to assume that, particularly in the large plants governed by the Act, good air quality management has been followed and that dangers to health and welfare have not been tolerated. There is, moreover, some data to support this assumption, in that EPA, after its initial review of the several applications for increased stack height credits for existing stacks that were filed after the 1979 proposed regulations were issued, became convinced that some or all of the increases were unjustified. *See* 45 Fed. Reg. at 42,281.

In the absence of a strong showing that this presumption is mistaken, it may be rebutted in individual cases only by a reliable indicator of the height needed to prevent dangers to health or welfare caused by downwash. In the present final regulations, EPA has severely undermined its claim that the formulas are such an indicator by allowing demonstrations to increase stack height above the formula height without any special indication that that was a class of sources for which the formulas were not likely to yield the right result. Such inconsistency is the hallmark of arbitrary action.

We remand for the EPA to reconsider whether, in light of its new understanding of "excessive concentrations," demonstrations are necessary before stack heights may be raised, even if the final height will not exceed formula height.

F. *Definition of "Stack" to Exclude Flares*

A flare is a pipe used in the oil, natural gas, and chemical industries to vent combustible gases by burning them

at the top. In its 1979 proposed regulations, EPA explicitly included "flare[s]" in its definition of the statutory term "stack." 44 Fed. Reg. at 2613. The affected industries, two government agencies, and the American Society of Mechanical Engineers submitted comments arguing that flares are different from stacks because flare height is intended not to disperse pollutants but to allow for the safe combustion of dangerous gases produced during malfunctions in the industrial process. For this reason and because it believed flare emissions were difficult to measure, EPA excluded flares from the definition of "stacks" in its reproposed and final regulations. *See* 47 Fed. Reg. at 5868 (to be codified at 40 C.F.R. § 51.1(ff)) (" 'Stack' means any point in a source designed to emit solids, liquids, or gases into the air, including a pipe or duct but not including flares."); *id.* at 5867; 46 Fed. Reg. at 49,817, 49,820. NRDC and Sierra Club argue that "flare stacks" are essentially no different from stacks in that they vent emissions into the atmosphere, and that their height can be used to evade emissions limitations. Therefore, they say, EPA's exclusion of flares from the definition of "stack" is contrary to law.

We find that EPA's definition of the term "stack" is a reasonable interpretation of a more or less technical term by the agency charged with implementation of the statute, and therefore affirm its exclusion of flares. *See generally Zenith Radio Corp. v. United States*, 437 U.S. 443, 450 (1978) (agency's definition need not be the only reasonable one, but must be " 'sufficiently reasonable' to be accepted by a reviewing court") (quoting *Train v. NRDC*, 421 U.S. 60, 75 (1975)); *Lead Industries Ass'n v. EPA*, 647 F.2d 1130, 1147 (D.C. Cir.) ("Where different interpretations of the statute are plausible, so long as EPA's construction of the statute is reasonable we may not substitute our own interpretation for the Agency's."), *cert. denied*, 449 U.S. 1042 (1980).

The record supports the conclusion that the engineering community defines "stacks" to exclude flares, and that

flare height is intended, under standard engineering practice, primarily to safeguard personnel and structures from the heat, flames, and unburned toxic gases that emanate during flaring, rather than to disperse the resulting concentrations of pollutants. *See, e.g.*, J.A. at 200 (comments of American Society of Mechanical Engineers); *id.* at 195-96 (comments of Monsanto Co.); *id.* at 203 (comments of Shell Oil Co.); *id.* at 353-54 (comments of Chevron U.S.A., Inc.). Some flares, if the release is small enough or remote enough, burn the gases at ground level. *Id.* at 353 (distinguishing "elevated flares" from "pit flares" and "ground flares"). Moreover, in part because of this primary purpose, flares are generally erected in isolated areas where, unless there is a nearby terrain obstacle, downwash is generally not a problem. Therefore, the height demanded by safety might not be justifiable if the sole aim were to prevent downwash. This seems unlikely to have been Congress's intent. Finally, there is no mention of flares in the legislative history.[6] We affirm EPA's definition of stack to exclude flares.

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[6] Nevertheless, the pollutants produced by the combustion that takes place at the top of flares are regulated under the Clean Air Act just as the similar pollutants produced by the combustion that occurs at the base of the stacks are. *See, e.g., id.* at 346-47 (comments of Michigan Dept. of Natural Resources) (describing PSD limitations placed on ground level sulfur dioxide impact of burning hydrogen sulfide derived from natural gas). Therefore, there is presumably an incentive for a source to raise its flare above the height dictated by safety in order to be able to increase the dispersion of the pollutants produced. *See id.* (30-meter limit on flare height would reduce permissible SO_2 emissions from over 8000 to about 2000 pounds per day). This is precisely the kind of dispersion usage that Congress sought to forbid.

While it may be impracticable to prevent this abuse via the "good engineering practice" formulation developed by Congress to deal with stack heights, excessive flare height still might be a "dispersion technique" for which credit is barred under section 123(a)(2), 42 U.S.C. § 7423(a)(2) (Supp. V 1981). We do not think it plain, as intervenor American

G. *Definition of "Dispersion Techniques"*

Section 123 bars giving emission credit for tall stacks and "other dispersion techniques." EPA's final definition of "dispersion technique" includes, in addition to the tall stacks and intermittent or supplemental control systems mentioned in the statute, the "addition of a fan or reheater to obtain a less stringent emission limitation." Expressly excluded from the definition are reheating the gas stream to its original temperature after the use of a pollution control system, certain agricultural and silvicultural uses of smoke, and "combining the exhaust gases from several stacks into one stack." 47 Fed. Reg. at 5868 (to be codified at 40 C.F.R. § 51.1(hh)).

Sierra Club and NRDC object that the definition does not include a number of dispersion techniques that should

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Petroleum Institute asserts, that the term "any other dispersion technique" is directed at dispersion stratagems other than height. The statute commands that the degree of emission limitation required for "any air pollutant under an applicable implementation plan" shall not be affected by either *stack* height or any other dispersion technique. Since emissions of flares are regulated by the applicable implementation plans, and excess flare height is not excess "stack height," it may well be one of the "other dispersion techniques" regulated under section 123(a)(2).

We make no ruling on this question. While NRDC and Sierra Club have advanced the argument before this court, it was apparently not put before the agency, and we do not have its response. *See* J.A. at 911 (Sierra Club comments); *id.* at 1217 (petition for rehearing); *cf.* United States v. L.A. Tucker Truck Lines, 344 U.S. 33, 37 (1952) ("Simple fairness to those who are engaged in the tasks of administration, and to litigants, requires as a general rule that courts should not topple over administrative decisions unless the administrative body not only has erred but has erred against objection made at the time appropriate under its practice."). Moreover, there is no suggestion that flare height above that required for safety has ever been used as a dispersion technique or that the problem is anything more than a theoretical one. *See generally infra* p. 56.

be barred: (1) the use of fans and reheaters to avoid a more stringent emission limitation, rather than merely to gain a less stringent one, (2) the addition of nozzles and other devices to increase plume rise, (3) combining several stacks into one for the purpose of increasing plume rise, and (4) other such techniques polluters may devise in the future.

EPA's original proposal defined "dispersion technique" far more broadly than its final rule, so that it included "the manipulation of source process parameters, exhaust gas parameters, stack parameters other than height, or other selective handling of exhaust gas streams so as to increase the exhaust gas plume rise." 44 Fed. Reg. at 2613-14. It narrowed the definition in response to comments that persuaded the agency that "many changes in stack dimensions and exhaust gas characteristics are made to improve the efficiency of the facility rather than to enhance dispersion." Response to Petitiors for Reconsideration of the Stack Height Rules (May 1982), J.A. at 1225 [hereinafter cited as Reconsideration Decision]. In its reproposed regulations, the agency added an explicit test of a purpose to increase plume rise and provided that combining stacks would not be deemed a dispersion technique unless there was manipulation of flow rates or temperature for the purpose of enhancing plume rise. 46 Fed. Reg. at 49,817; *see id.* at 49,816 (preamble says "for the sole purpose of enhancing plume rise"). It commented that "[t]he significance of other dispersion techniques is not well documented and the Agency intends to give further consideration to the need for restrictions of this type prior to promulgation." *Id.* at 49,816.

In its final regulations, as noted, EPA abandoned the generic definition of "dispersion techniques" and limited the term to specific equipment—fans and reheaters—installed for the purpose of obtaining a less stringent limitation. It eliminated any test of intent in the permission to combine several stacks into one. The agency explained

that the change would "prevent only the installation of equipment clearly intended to enchance [sic] plume rise." 47 Fed. Reg. at 5867. It declined to prohibit other techniques that were accompanied by such an intent because such a test "would involve the Agency in subjective judgments that could be difficult to support." Reconsideration Decision, *supra* p. 51, at 1225; *accord id.* at 1226 ("Such subjective judgments would be difficult to make and to enforce."). "A test based on the installation of specific equipment accompanied by a request for a relaxed emission limit was deemed to be more workable." *Id.* at 1225. EPA did not dispute that all the techniques cited by petitioners could be used in order to increase plume rise and disperse pollutants so as to lower emissions limitations.

While somewhat less than ideally clear, EPA's explanations may be read to suggest that it weighed two factors in deciding which of these techniques it would even attempt to regulate: the likelihood that they would be used as dispersion techniques, rather than as bona fide engineering improvements (i.e., the "significance" of these techniques), and the burden, both on enforcement agencies and on industry, of attempting to differentiate legitimate from illegitimate uses. EPA did not argue that use of these techniques in order to increase plume rise would not be a "dispersion technique" within the meaning of the statute. Rather, it became convinced that few would use such techniques and that the effort of catching those who did would be great. In so doing, however, we think EPA has created an exemption from the statute based upon its perceptions of the costs and benefits of enforcing the law. We find no source for such a power. *See Alabama Power Co. v. Costle*, 636 F.2d 323, 357 (D.C. Cir. 1979) ("[T]here exists no general administrative power to create exemptions to statutory requirements based upon the agency's perceptions of costs and benefits.").

Although EPA has not argued to the contrary, we first ascertain for ourselves that the techniques cited by peti-

tioners are within the intended meaning of the statutory term "dispersion techniques." The language of the Act is categorical—the amount of emission limitation "shall not be affected in any manner by . . . any . . . dispersion technique"—and a broad construction is appropriate to achieve the remedial purpose intended. There is no helpful legislative history to shed light on the meaning of the term. We think the words themselves, however, sweep broadly enough to encompass at least the meaning urged by petitioners: the use of devices, alterations to the stack, or other techniques when they are significantly motivated by an intent to gain emissions credit for greater dispersion. Were such techniques not included, they could be used to enhance plume rise to such an extent as to make the limitations on stack height illusory.

Since the regulations do not regulate all the techniques contained in this definition, the regulations effectively create an exemption not indicated in the statute itself. Such categorical exemptions are generally not favored, *Alabama Power*, 636 F.2d at 358, but there are two situations in which they are allowed: cases of administrative necessity and de minimis situations, *id.* at 358-61. EPA has vaguely invoked both of these justifications. However, both must be shown with greater rigor than EPA has brought to bear here. *See id.* at 359 (agency bears "a heavy burden to demonstrate the existence of an impossibility"); *id.* at 360 ("Determination of when matters are truly *de minimis* naturally will turn on the assessment of particular circumstances, and the agency will bear the burden of making the required showing.").

Apparently the only evidence concerning whether prohibiting these techniques would yield a gain of trivial or no value (in the sense of furthering the goals of the statute) consists of EPA's finding that "many changes in stack dimensions and exhaust gas characteristics are made to improve the efficiency of the facility rather than to enhance dispersion." Reconsideration Decision, *supra*

p. 51, at 1225, and like comments submitted by industry, *e.g.*, J.A. at 1029 (comments of Utility Air Regulatory Group) ("Recombination of exhaust streams is typically done for sound economic and engineering reasons, totally apart from any environmental plume rise that might occur."); *id.* at 101-02 (comments of Stearns-Roger Inc.) (listing engineering reasons for manipulating exhaust gas velocity, temperature, etc.). Even these few, unspecific, unquantified estimates do not attempt to establish that use of these techniques in order to disperse pollutants more widely would only trivially undermine the Act's command that emissions limitations be met by direct controls. Neither the comments nor EPA's responses suggest, for example, that there is in fact no or little incentive to implement these techniques because the potential reduction in emissions limitations would not be worth the cost. Clearly, more is required to show that a technical violation is truly de minimis.

There is more evidence to support EPA's claim of administrative necessity, and that is where it has placed its primary reliance. One local agency asserted that enforcement of the original broad definition of dispersion techniques would require scrutiny of "every possible aspect of source construction, process flows, plant configuration and siting," which, it said, was beyond its capabilities. *Id.* at 314 (comments of Allegheny Co. Bureau of Air Pollution Control). Several states expressed less vehement concerns about their ability to draw the lines required by the various proposals. *See id.* at 965 (comments of Conn. Dept. of Environmental Protection) (inquiring how a state could establish with any certainty that enhanced plume rise "was an intentional or an incidental result" of changes to stack flow characteristics); *id.* at 236 (comments of S.C. Dept. of Health & Environmental Control) (seeking list of stack parameters for various source categories to be used in comparing changes proposed by sources). EPA found that discerning the subjective motivation for stack and flow parameter changes, as required

by its 1981 reproposal, would be "difficult." Reconsideration Decision, *supra* p. 51, at 1225, 1226.

We do not see anything in the language, history, or purpose of section 123 that "authorizes approaches that deviate from the legislative mandate in response to concerns about feasibility," *Alabama Power*, 636 F.2d at 360. The House committee report sternly cautions the Administrator to construe narrowly exceptions and permitted variances from the bar on reliance on dispersion techniques. *See* HOUSE REPORT, *supra* p. 5, at 93-94. Other legislative history, *e.g.*, 123 CONG. REC. 18,027 (1977) (remarks of Sen. Muskie) (quoted *supra* p. 7), as well as the detailed cabining of the Administrator's discretion in the statute itself, suggest some distrust of the agency's prior flexibility towards industry.

In the absence of an authorization to take feasibility into account in administering a particular statute, the agency may avoid implementing a statute only by showing that attainment of the statutory objectives is impossible. *See Alabama Power*, 636 F.2d at 359 ("the agency [bears] a heavy burden to demonstrate the existence of an impossibility" (footnote omitted)); *NRDC v. Train*, 510 F.2d 692, 713 (D.C. Cir. 1975) ("The sound discretion of an equity court does not embrace enforcement through contempt of a party's duty to comply with an order that calls him 'to do an impossibility.'" (footnote omitted)). Especially in light of the fact that the administrative difficulties the agency cites are mere predictions, rather than conclusions drawn from good faith efforts at enforcement, *see Alabama Power*, 636 F.2d at 359 ("The agency's burden of justification in such a case is especially heavy."), the showing here falls far short.

Moreover, even if separately determining the intent of all manipulations of stack or plume parameters that are likely to be used as dispersion techniques is in fact impossible, there nevertheless may be less taxing ways to enforce the law. EPA could, for example, develop classes

of plant improvements that are clearly legitimate or clearly illegitimate. *See id.* at 358 ("Courts frequently uphold streamlined agency approaches or procedures where the conventional course, typically case-by-case determinations, would, as a practical matter, prevent the agency from carrying out the mission assigned to it by Congress."); *see also* J.A. at 236 (comments of S.C. Dept. of Health & Environmental Control) (suggesting "list of stack parameters for various source categories that can be used in the comparative analysis"). It might be able to quantify the amount of plume rise that could be presumed to have an engineering, rather than a dispersion, rationale, in the manner that one commenter suggested. *Id.* at 978-79 (comments of ASARCO Inc.) (proposing to permit exit velocities of 1.5 times the 95th percentile of local windspeeds raised to the fifth power). EPA might also be able to select large classes of improvements that may be exempted from regulation because their use as dispersion techniques is no more than a theoretical possibility or their impact on the goals of the Act is otherwise trivial. By thus focusing enforcement resources narrowly on the plant improvements likely to be undertaken for the purposes of increasing dispersion, EPA should be able to reduce substantially the number of cases in which a full-scale examination of the motivation for the change will be required.[7]

We see no evidence that EPA has adequately explored these regulatory alternatives. Rather, when it appeared that the definition of "dispersion techniques" would depend on a question of intent, the agency simply caved in and allowed full credit for any plume enhancement tech-

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[7] We do not, of course, specifically approve the use of any of these techniques for easing the regulatory burden, but offer all of them merely as suggestions of ways in which the claimed impossibility of inquiring into intent in all cases may be mitigated. Others will no doubt occur to the agency as it gains experience in the field.

nique not involving fans or heaters. We overturn the narrow definition of "dispersion techniques" and direct EPA to develop rules disallowing credit for all "dispersion techniques" as that term is used in section 123, unless the agency can justify its failure under the standards discussed in this opinion and in the opinion of this court in *Alabama Power*, 636 F.2d at 357-61.

H. *Definition of "Stack Height in Existence"*

Section 123(a) contains a grandfather clause intended to exempt pre-1971 stacks from the limitation on emission credit contained in the "good engineering practice" provision. Other dispersion techniques implemented before the enactment of the Clean Air Amendments of 1970 are also exempted from emission credit limits. The clause reads, "The preceding sentence shall not apply with respect to stack heights in existence before December 31, 1970, or dispersion techniques implemented before such date." 42 U.S.C. § 7423(a) (Supp. V 1981).

EPA's final regulations define a stack "in existence" to mean that the owner or operator of the source had, by December 31, 1970,

> (1) begun, or caused to begin, a continuous program of physical on-site construction of the stack or (2) entered into binding agreements or contractual obligations, which could not be cancelled or modified without substantial loss to the owner or operator, to undertake a program of construction of the stack to be completed in a reasonable time.

47 Fed. Reg. at 5868 (to be codified at 40 C.F.R. § 51.1(gg)). Sierra Club and NRDC object that this definition is contrary to the plain English meaning of the statutory language, as well as to the legislative history. They urge a definition like that contained in the 1979 proposed regulations: "'In existence' . . . means that stack height (of a stack) which has been constructed." 44 Fed. Reg. at 2613. EPA adverts to the legislative history

and clear purpose of the provision to grandfather sources that before the 1970 amendments made good faith commitments to use certain stack heights. In 1981 Responses, *supra* p. 29, at 1164. An EPA study of the impact of the stack height regulations stated that the change in the definition of "in existence" would exempt stacks at four to eight power plants from the requirements of section 123. Impact Assessment Report for the Final Stack Heights Regulations (Dec. 1981), J.A. at 1054, 1059 [hereinafter cited as Impact Assessment Report].

The weightiest evidence in favor of the narrower 1979 definition is the fact that the 1977 amendments elsewhere explicitly refer to facilities as to which construction contracts had been awarded as of a certain date, suggesting that "in existence" means some stage beyond the signing of the contract. Section 123 itself in effect exempts the stacks at a single power plant in Tennessee, known as the Kingston Station, *see* 123 CONG. REC. 18,480-81 (1977) (remarks of Sen. Baker), in part by referring to stacks "for which a construction contract was awarded before February 8, 1974." 42 U.S.C. § 7423(a) (Supp. V 1981); *see also id.* §§ 7475(a), 7479(2) (PSD program applies to facilities "on which construction is commenced after August 7, 1977"; "commenced" defined to mean that the operator has obtained all necessary permits and has begun continuous program of construction or has entered into binding agreements to do so, which cannot be modified without substantial loss). The distinction between these provisions and the grandfather clause under review was the primary basis for EPA's original proposal that "in existence" be defined as physically constructed. *See* 44 Fed. Reg. at 2611 ("Since Congress in 1977 defined 'commenced construction' to include the acquisition of permits, the beginning of actual construction or the entering into binding contracts, EPA believes the term 'in existence' must mean something more.").

NRDC and Sierra Club also cite language in the House committee report that "sources which raised their stacks

or constructed tall stacks after the date of enactment should [not] be eligible for any credit," HOUSE REPORT, *supra* p. 5, at 93, which they say indicates an intent to include stacks under construction in section 123.

Nevertheless, we find EPA's final definition of the term to be a reasonable one and affirm it. *See supra* pp. 48-49. EPA's interpretation is necessary to make the clause equitable, which was undoubtedly Congress's purpose. Thus, the House committee report explained that the committee "believe[d] that sources which in good faith raised their stacks before the 1970 act limited dispersion methods should not be penalized." HOUSE REPORT, *supra* p. 5, at 93. Clearly, a source that irrevocably and in good faith contracted for a tall stack prior to the 1970 act may be penalized by application of the provision in the same way that one that had completed construction of the stack would be. Our emphasis on the words "in good faith" and "penalized" in the language from the House report is not contradicted by the passage cited by petitioners. Petitioners emphasize in their passage the words "raised their stacks or constructed tall stacks after the date of enactment," which they say means that any stack that was not completed prior to the date of enactment should be included in the statute. The two passages appear close together and were evidently meant to refer to the same distinction between stacks that were to be included in section 123 and those that were not. Yet one uses both the words "raised" and "constructed" and the other uses just "raised," which suggests that the words were not written with the special emphasis petitioners ascribe to them. In any case, there is no reason why the terms "raised" and "constructed" should not be read to mean the entire process of raising or constructing stack height, from beginning to end.

Also, a similar grandfather clause in EPA's 1976 stack height guidelines, which we have said were, along with their 1973 predecessors, the source for much of the

detail in section 123, drew the line at commencement of construction. 1976 Guideline, *supra* p. 6, at 7451 ("a State may not take into account the dispersive effects of an increased stack height for which construction commenced after January 31, 1972"). Moreover, the 1976 guidelines set out this grandfather clause in a section headed, "*Sources in Existence Prior to January 31, 1972*," which might have been the origin of the statutory language. Under the guidelines, a source that was under construction in 1972 would be exempt from the stack height limits, and thus "in existence," if construction of its stack height had commenced. Thus, the term "in existence" in the guidelines could in some instances mean "under construction," the definition urged by EPA.

Further evidence that Congress did not mean the term "in existence" to exclude stack heights contracted for or under construction is that the use of that term in another section of the 1977 amendments must be so read to achieve Congress's purpose. A section of the PSD provisions requires certain sources "in existence on August 7, 1977," to install the best available retrofit technology to reduce visibility impairment produced by the source's emissions. 42 U.S.C. § 7491(b)(2)(A) (Supp. V 1981). The general permit provisions for new facilities require more stringent protection of visibility for all facilities "on which construction is commenced after August 7, 1977." *Id.* § 7475(a); *see also id.* § 7479(2)(A) (definition of "commenced" to include "entered into binding agreements"). Thus, in order to provide some regulation of visibility for sources under construction or contracted for on August 7, 1977, "in existence" must be read to mean "on which construction has commenced." EPA urges a parallel construction here. *See Alabama Power Co. v. Costle*, 636 F.2d 323, 396 (D.C. Cir. 1979) ("[W]e must assume that the meaning of a particular term is to be consistent throughout the Act.").

The legislative history of the "Kingston exemption" diminishes any inferences that may be drawn from the

fact that it uses the phrase "for which a construction contract was awarded" to mean essentially what EPA urges as the definition of "in existence." This provision was added to the bill on the floor of the Senate at the instance of Senator Howard Baker in order to exempt a particular plant in his home state of Tennessee. *See* 123 CONG. REC. 18,480-81 (1977). It was thus drafted by a different author, added late in the process when it was too late to check it for consistency with other sections of the Act, and debated without the benefit of a committee report and with attention focused only on its purpose as opposed to its details. Senator Baker may have seen some ambiguity in the term "in existence" and used more specific language to ensure that his purpose was achieved. We do not think the possibility that one senator thought the statute's grandfather clause was ambiguous rebuts the other persuasive evidence of the reasonableness of EPA's interpretation of congressional intent.

We affirm EPA's definition of "in existence."

Sierra Club and NRDC argue that the grandfather clause is subject to abuse unless EPA bars sources from receiving emission credit for emissions from new facilities tied into their grandfathered tall stacks. Such a provision was included in the preamble to the 1979 proposed regulations, 44 Fed. Reg. at 2612 ("credit only for emissions from facilities that before December 31, 1970 were committed to tie into a stack in existence as defined in this Regulation") but was deleted without explanation in the 1982 final regulations. EPA admits that it neglected to respond to Sierra Club's comment that the provision be included in the final regulations themselves, but argues that the failure was at most harmless error. Since the failure to respond leaves us "to guess as to the agency's findings or reasons," *Greater Boston Television Corp. v. FCC*, 444 F.2d 841, 851 (D.C. Cir. 1970), *cert. denied*, 403 U.S. 923 (1971), and we may not uphold

agency action on the basis of arguments advanced not by the agency itself, but only by counsel during litigation, *FPC v. Texaco Inc.*, 417 U.S. 380, 397 (1974), we remand this issue to allow the agency to explain why it refused to prohibit tying new sources into pre-1971 stack heights.

I. *Prospective Application of 1+1.5 Rule*

As noted, EPA's regulations provide two formulas for the determination of GEP height: the 2.5 Rule for use by stacks in existence (as defined in the regulations) on January 12, 1979, and the 1+1.5 Rule for all other stacks. 47 Fed. Reg. at 5868 (to be codified at 40 C.F.R. § 51.1(ii)(2)). The dividing date is the day on which the agency published its 1979 proposed regulations, in which it first proposed the 1+1.5 Rule. Retroactive application of the new formula was eschewed because it was thought to be unfair to sources that "in good faith had constructed stacks in accordance with" the previously accepted 2.5 Rule. *Id.* at 5866.

Sierra Club and NRDC argue that the two-formula approach is contrary to the Act, which allows credit only for good engineering practice height, as determined by the Administrator. Once EPA determines that the relevant amount of downwash can be prevented by a certain height, it must give credit only for that height. Allowing application of the 2.5 Rule, the argument goes, gives credit for stack height in excess of GEP height. In addition, petitioners cite the conference committee's report, which states the committee's intention that "if it should be determined that downwash, eddies, and wakes can be prevented by stacks of less than 2½ times facility height, the Administrator's rule should give 'credit' only for the height needed to avoid these conditions." 123 CONG. REG. 27,071 (1977).

We hold that the statute does not prevent EPA from allowing its past rule to be applied to stacks built be-

fore its new formula was proposed, but that the agency has erred in allowing sources that did not rely on the old formula to use it. Congress was moved to enact section 123 by evidence that during the 1970's many sources had built tall stacks far above the heights dictated by sound engineering practice. To allow such sources to claim credit for heights up to the 2.5 Rule would be a windfall for them, unjustifiable under either the statute or the equitable considerations that govern retroactivity.

Although the conference committee directed that the Administrator's rule give credit only for whatever height he determined was needed to prevent downwash, it did not speak to whether that rule should be applied retroactively or only prospectively. The courts have addressed the limits of an agency's implied power to apply a rule retroactively and have discerned a set of considerations that limit that power. We think that these considerations are also suggestive of the outlines of an agency's duty to apply a rule retroactively, although the weight of each will be somewhat different. Among the considerations that enter into the consideration of retroactivity are

> [1] whether the new rule represents an abrupt departure from well established practice or merely attempts to fill a void in an unsettled area of law, [2] the extent to which the party against whom the new rule is applied relied on the formed rule, [3] the degree of the burden which a retroactive order imposes on a party, and [4] the statutory interest in applying a new rule despite the reliance of a party on the old standard.

Retail, Wholesale & Department Store Union v. NLRB, 466 F.2d 380, 390 (D.C. Cir. 1972) (retroactive application of rule developed in adjudications); *see Tennessee Gas Pipeline Co. v. FERC*, 606 F.2d 1094, 1116 n.77 (D.C. Cir. 1979) (same: "The relevant factors [concerning the limitations on permissible retroactivity] include

the degree of retroactivity, the need for administrative flexibility, and the hardship on the affected parties."), *cert. denied*, 445 U.S. 920 (1980), 447 U.S. 922 (1980).

In this case, the new rule is a departure from both a legal rule proposed in 1973 and in effect since 1976, and an industry practice of much longer standing. *See* Technical Support Doc., *supra* p. 20, at 1080 ("[The 2.5 Rule] arose during the early part of this century as a practical formula."); *cf. NLRB v. Majestic Weaving Co.*, 355 F.2d 854, 860 (2d Cir. 1966) (Friendly, J.) (Every case of first impression has a retroactive effect, "[b]ut the problem of retroactive application has a somewhat different aspect in cases not of first but of second impression, where an agency alters an established rule defining permissible conduct which has been generally recognized and relied on throughout the industry that it regulates."). Moreover, for operators with tall, thin buildings who have met air quality standards with a stack height two-and-one-half times the height of the building, the burden of retroactivity may include expensive retrofitting of control equipment and renegotiation of contracts in order to purchase coal with lower sulfur content. *See* J.A. at 926 (comments of Utility Air Regulatory Group).

The statutory interest in applying the new rule despite individual reliance is, of course, the crucial consideration in the context of requiring an agency to apply one of its rules retroactively. Here, any retroactivity detracts from the intention to place maximum reliance on direct emissions reductions rather than dispersion. But the objective, while paramount, did not completely eclipse others, for Congress itself allowed full credit for stack height in existence before 1970. Also, the determination of GEP stack height was explicitly left to the discretion of the Administrator, and the statute here specifically envisioned the old rule that EPA seeks to retain in force for some sources. Thus, the application of that rule would not

maintain a situation that Congress sought to end. Finally, we do not think the conference committee report was intended to allow only a single review of the state of engineering knowledge in order to determine what stack height is needed to prevent downwash, but rather that it would tolerate refinement of the approach as knowledge expanded. Likewise, we have noted that the technical basis for establishing certain rules may be available only after some experience in regulating the field is gained. *See supra* pp. 55-56 & n.7. Yet, a rule that required that every refinement of the GEP formulas or of demonstration techniques be applied retroactively would place the natural reluctance to act unfairly or inequitably as an obstacle to implementation of those developments. We do not think the statute requires such a result, particularly since retroactive application may frequently be quite burdensome for particular sources.

Nevertheless, one of the factors to be considered in determining retroactivity is the extent of reliance on the old rule. In this case, there is persuasive evidence that many sources built stacks in the relevant period without in fact relying on the 2.5 Rule, but instead built their stacks tall in order to obtain credit for dispersion. *See e.g.*, HOUSE REPORT, *supra* p. 5, at 81-82; 123 CONG. REC. 16,203 (1977) (remarks of Rep. Waxman during introduction of amendments) ("[T]he utility industry in particular has tried to gain acceptance for operating methods which only disperse harmful emissions over a large area, which are unreliable in practice and which mask each source's contribution to a region's air quality problems. . . . I feel that the committee has finally, after a half-dozen years, laid this argument to rest."); *Alabama Power Co. v. Costle*, 636 F.2d 323, 388 (D.C. Cir. 1979) ("A good many industrial facilities . . . [built] taller-than-necessary stacks in order to achieve greater dispersion of their emissions and thus comply with national ambient standards."). *Compare* Impact Assess-

ment Report, *supra* p. 58, at 1059 (eight plants built tall stacks before 1971) *with* Identifying and Assessing the Technical Bases for the Stack Height Regulatory Analysis (Dec. 1979) (EPA consultant's report), J.A. at 713 (171 stacks over 500 feet tall built since 1970). Putting an end to this evasion of the act was, in fact, the primary motivation for section 123. Thus although we would be concerned by the burden caused by retroactive application of the new rule against sources that actually relied on the old rule, such concerns are rather attenuated when there was no reliance whatsoever. In these circumstances, both judicial doctrine and congressional purpose command that the agency limit the use of the 2.5 Rule to those sources that actually relied on it.

We remand this provision to the agency to allow it to reformulate its rule to take actual reliance into account.

J. *Timetable for State Implementation*

Section 406(d)(2) of the 1977 amendments provides:

> Except as otherwise expressly provided, each State required to revise its applicable implementation plan by reason of any amendment made by this Act shall adopt and submit to [EPA] such plan revision before the later of the date—
>
> (A) one year after the date of enactment of this Act [Aug. 7, 1977], or
>
> (B) nine months after the date of promulgation by [EPA] of any regulations under an amendment made by this Act which are necessary for the approval of such plan revision.

42 U.S.C. § 7401 note (Supp. V 1981). In the preamble to its final regulations, EPA purported to carry out this section via a two-stage implementation process. First, the states would be allowed nine months from the promulgation of the regulations to draft and submit rules limiting stack height credit. Then, presumably after a four-month period of review by EPA, *see id.* § 7410(a)(2) ("The Administrator shall, within four months after the

date required for submission of a [state implementation plan], approve or disapprove such plan or each portion thereof."), the states would have another nine months to revise their emission limitations to make them consistent with the state rules. 47 Fed. Reg. at 5865-66; Reconsideration Decision, *supra* p. 51, at 1227.

EPA's two-stage process, allowing a total of twenty-two months between promulgation of EPA's regulations and submission of revised emission limitations (followed, presumably, by another four months for EPA approval), is plainly contrary to section 406(d)(2). The "applicable implementation plan" referred to in that section is the state implementation plan required under section 110, 42 U.S.C. § 7410 (Supp. V 1981); the latter section explicitly requires that state implementation plans contain "emission limitations, schedules, and timetables for compliance with such limitations," *id.*; *see also id.* § 7471 (requiring plan to contain "emission limitations and such other measures as may be necessary . . . to prevent significant deterioration of air quality"); *id.* § 7502(b)(8) (same as to nonattainment provisions of Act). There is thus no place in the statutory timetable for submission of separate state regulations governing stack heights.

Moreover, we see no place for such state regulations in EPA's own final regulations. The regulations are detailed and precise and do not mention alternative means of compliance from which the states may pick and choose. Even if states had to adopt stack height regulations, they would probably merely mimic EPA's version. In any case, that process could not extend the time allowed by statute for submission of implementation plans containing specific emissions limitations.

In its brief before this court, EPA's lawyers assert that the agency "made a specific finding that it would be impossible for the states to completely revise their plans within nine months." Brief of Respondents at 63 (citing

J.A. at 1233). We find no such specific finding on the page cited by the brief nor in the other materials in the record regarding the timetable for state implementation. This conclusory statement certainly does not meet the "heavy burden to demonstrate the existence of an impossibility" that is required by the law, *Alabama Power Co. v. Costle*, 636 F.2d 323, 359 (D.C. Cir. 1979).

EPA's two-stage implementation plan is reversed.

K. *Timetable on Remand*

Congress directed EPA to promulgate regulations to carry out section 123 of the Act no later than six months after it was passed in August 1977. EPA's proposed regulations were not issued until January 1979, seventeen months after enactment. Its final regulations were promulgated four-and-one-half years after the statute was passed. We have now passed the sixth anniversary of that date. During this time, polluters have not been obliged to reduce their emissions rather than rely on dispersion, because the statute must be implemented by the states, which have awaited EPA's regulations.

Petitioners request that we direct EPA to promulgate "without delay" regulations free of the violations we have found. In light of the regulatory history set out above and the now urgent need to implement Congress's commands, we think it best to quantify that obligation. We note that many, though not all, of the flaws we have found in EPA's regulations were reversals of positions taken in the 1979 proposed regulations, so that we have some confidence that solutions are not beyond the realm of imagination. Others will require the expenditure of considerable effort to correct, but Congress thought EPA could solve all problems in six months and the agency has had six years. We think it appropriate to direct EPA to promulgate new final regulations that remedy the defects this court has found within six months from the issuance of our mandate, the period originally specified by Congress.

III

The following provisions of EPA's stack height regulations are affirmed: (1) the definition of "nearby" as applied in the GEP formulas; (2) the failure to consider plume rise in deriving the GEP formulas; (3) the exclusion of flares from the definition of "stack"; and (4) the definition of "in existence."

The following provisions are reversed as beyond the agency's statutory authority: (1) the inclusion of plume impaction in the calculation of creditable stack height; and (2) the two-step, twenty-two-month timetable for state implementation of the regulations.

We remand the following provisions to the EPA for further action not inconsistent with this opinion: (1) the failure to apply a "nearby" limitation to GEP demonstrations; (2) the definition of "excessive concentrations"; (3) the failure to require demonstrations before stacks are raised up to formula height; (4) the definition of "dispersion technique"; (5) the refusal to prohibit new facilities from tying into pre-1971 stack heights; and (6) the grandfather clause for application of the 2.5 Rule.

We direct EPA to promulgate new final stack height regulations as to these issues within six months from the date of issuance of this court's mandate.

It is so ordered.

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

September Term, 1983

No. 82-1384

SIERRA CLUB AND NATURAL RESOURCES
DEFENSE COUNCIL, INC.
Petitioners

v.

ENVIRONMENTAL PROTECTION AGENCY
Respondent

ALABAMA POWER COMPANY, et al.
KENNECOTT MINERALS CO.,
TENNESSEE VALLEY AUTHORITY
STATES OF NEW YORK, et al.
STATE OF VERMONT
AMERICAN PETROLEUM INSTITUTE, et al.
Intervenors

And Consolidated Case Nos. 82-1412,
82-1845 & 82-1889

[Filed Dec. 13, 1983]

Before: EDWARDS, *Circuit Judge*; MCGOWAN and MACKINNON, *Senior Circuit Judges*

ORDER

On consideration of the Petition for Rehearing of Intervenor Alabama Power Co., et al, filed November 29, 1983, it is

ORDERED by the Court that the aforesaid Petition is denied.

Per Curiam

For The Court:

GEORGE A. FISHER
Clerk

By: /s/ Robert A. Bonner
ROBERT A. BONNER
Chief Deputy Clerk

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

September Term, 1983

No. 82-1384

SIERRA CLUB AND NATURAL RESOURCES
DEFENSE COUNCIL, INC.,
Petitioners

v.

ENVIRONMENTAL PROTECTION AGENCY,
Respondent

ALABAMA POWER COMPANY, et al.
KENNECOTT MINERALS CO.,
TENNESSEE VALLEY AUTHORITY
STATES OF NEW YORK, et al.
STATE OF VERMONT
AMERICAN PETROLEUM INSTITUTE, et al.
Intervenors

And Consolidated Case Nos. 82-1414,
82-1845 & 82-1889

[Filed Dec. 13, 1983]

Before: ROBINSON, *Chief Judge*, WRIGHT, TAMM, WILKEY, WALD, MIKVA, EDWARDS, GINSBURG, BORK, SCALIA and STARR, *Circuit Judges*; MCGOWAN and MACKINNON, *Senior Circuit Judges*

ORDER

The suggestion for rehearing *en banc* of Intervenor Alabama Power Co., et al, filed November 29, 1983, has

been circulated to the full Court and no member has requested the taking of a vote thereon. On consideration to the foregoing, it is

ORDERED by the Court *en banc* that the aforesaid suggestion is denied.

Per Curiam

For The Court:

GEORGE A. FISHER
Clerk

By: /s/ Robert A. Bonner
ROBERT A. BONNER
Chief Deputy Clerk

Circuit Judges Wright, Wilkey and Bork did not participate in this Order.

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

September Term, 1983

No. 82-1384

SIERRA CLUB AND NATURAL RESOURCES DEFENSE COUNCIL, INC.,
Petitioners

v.

ENVIRONMENTAL PROTECTION AGENCY,
Respondent

ALABAMA POWER COMPANY, et al.
KENNECOTT MINERALS CO. &
TENNESSEE VALLEY AUTHORITY
STATES OF NEW YORK, et al.
STATE OF VERMONT
AMERICAN PETROLEUM INSTITUTE, et al.
Intervenors

And Consolidated Case Nos. 82-1412,
82-1845 & 82-1889

[Filed Dec. 13, 1983]

Before: EDWARDS, *Circuit Judge*; MCGOWAN and MACKINNON, *Senior Circuit Judges*

ORDER

On consideration of the Motion of Alabama Power Co., et al. for Clarification of the Court's Decision on "Nearby Terrain Obstacles", filed November 25, 1983, it is

ORDERED by the Court that the aforesaid motion for clarification is denied.

Per Curiam

For The Court:

GEORGE A. FISHER
Clerk

By: /s/ Robert A. Bonner
ROBERT A. BONNER
Chief Deputy Clerk

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

September Term, 1983

No. 82-1384

SIERRA CLUB AND NATURAL RESOURCES DEFENSE COUNCIL, INC.,
Petitioners

v.

ENVIRONMENTAL PROTECTION AGENCY,
Respondent

ALABAMA POWER COMPANY, et al.
KENNECOTT MINERALS CO.,
TENNESSEE VALLEY AUTHORITY
STATES OF NEW YORK, et al.,
STATE OF VERMONT
AMERICAN PETROLEUM INSTITUTE, et al.,
Intervenors

And Consolidated Case Nos. 82-1412,
82-1845 & 82-1889

[Filed Jan. 6, 1984]

Before: EDWARDS, *Circuit Judge*, MCGOWAN and MACKINNON, *Senior Circuit Judges*

ORDER

On consideration of the motion of intervenor for stay of issuance of mandate, it is

ORDERED by the Court that the Clerk is directed to delay issuance of this Court's mandate through January 19, 1984.

Per Curiam

For The Court:

GEORGE A. FISHER,
Clerk

By: /s/ Robert A. Bonner
ROBERT A. BONNER
Chief Deputy Clerk

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

September Term, 1983

No. 82-1384

SIERRA CLUB AND NATURAL RESOURCES DEFENSE COUNCIL, INC.
Petitioners

v.

ENVIRONMENTAL PROTECTION AGENCY
Respondent

ALABAMA POWER COMPANY, et al.,
Intervenors

And Consolidated Cases No. 82-1412,
82-1845 & 82-1889

[Filed Feb. 9, 1984]

Before: EDWARDS, *Circuit Judge*, MCGOWAN and MACKINNON, *Senior Circuit Judges*

ORDER

On consideration of the motion of Intervenors, Alabama Power Company et al., to further stay mandate and of the opposition thereto, it is

ORDERED by the Court that the motion is granted and the Clerk is directed to not issue the mandate of this Court through February 21, 1984.

Per Curiam

For The Court:

GEORGE A. FISHER
Clerk

By: /s/ Robert A. Bonner
ROBERT A. BONNER
Chief Deputy Clerk

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 51

[AD-FRL 2010-1; Docket No. A-79-01]

Stack Height Regulations

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rulemaking.

SUMMARY: Section 123 of the Clean Air Act requires EPA to promulgate regulations to assure that the degree of emission limitation required for the control of any air pollutant under an applicable State Implementation Plan (SIP) is not affected by that portion of any stack height which exceeds good engineering practice (GEP) or by any other dispersion technique. Regulations to implement Section 123 were proposed on January 12, 1979 at 44 FR 2608 and repropcsed October 7, 1981 at 46 FR 49814. Today's action incorporates changes to the reproposal and finalizes these regulations.

DATE: These rules are effective March 10, 1982.

ADDRESS: Docket A-79-01, containing material relevant to this action, is located in the Central Docket Section (A-130), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460.

FOR FURTHER INFORMATION CONTACT: Mr. Bruce Polkowsky, MD-15, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711. Telephone: (919) 541-5540.

SUPPLEMENTARY INFORMATION:

Docket Statement

All pertinent information concerning the development of these regulations is included in Docket No. A-79-01.

The Docket is open for inspection by the public between the hours of 8:00 a.m. and 4:00 p.m., Monday through Friday, at the EPA Central Docket Section, West Tower Lobby, Gallery One, 401 M Street, S.W., Washington, D.C. Background documents normally available to the public, such as Federal Register notices and Congressional reports, are not included in the docket. A reasonable fee may be charged for copying documents.

I. Background

A. Statute

Section 123 was added to the Clean Air Act by the 1977 Clean Air Act Amendments. It prohibits stacks taller than good engineering practice (GEP) height and other dispersion techniques from affecting the emission limitations required to meet the national ambient air quality standards (NAAQS) or prevention of significant deterioration air quality increments (PSD increments). Section 123 requires EPA to promulgate regulations which define GEP stack height, and which restrict the use of other dispersion techniques, including intermittent or supplemental control techniques. This rulemaking fulfills this requirement. In the near future, EPA also intends to propose rules on the use of intermittent control techniques.

B. Rulemaking

On January 12, 1979 (44 FR 2608), EPA published a notice proposing limitations on stack height credit and other dispersion techniques. The notice proposed specific rules to be used in determining GEP stack height for any source and specific requirements for State Implementation Plan (SIP) revisions. EPA provided an extended period for the submission of public comments on these proposed regulations. EPA held a public hearing on May 31, 1979 followed by a 30-day period for the submission of additional comments (44 FR 24329, April 25, 1979).

EPA provided for comments on additional technical information (44 FR 40359, July 11, 1979 and 46 FR 24596, May 1, 1981). Finally, EPA recently reproposed the regulations with changes made in response to the comments received (46 FR 49814, October 7, 1981).

Forty individuals and groups commented on the October 1981 proposal. EPA has considered all comments and has made a number of changes in the regulations in response to these comments. Most of these changes simply clarify the proposed rules. The revisions are outlined in Section IV: "Changes in the Regulations from the October 1981 Proposal." In addition, EPA has prepared a document entitled "Summary of Comments and Responses on the October 7, 1981 Proposal of the Stack Height Regulations." This document has been placed in Docket A-79-01, and, depending upon available supplies, copies may also be obtained from: EPA Library (MD-35), U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711. A copy of this document will be sent to all persons who submitted comments on the October 1981 proposal.

C. Documents

In conjunction with the regulations, EPA developed several technical and guidance documents. These served as background information for the regulations and all are included in Docket No. A-79-01. The following documents have been placed in the National Technical Information Service (NTIS) system and may be obtained by contacting NTIS at 5285 Port Royal Rd., Springfield, Virginia 22161.

(1) "Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for Stack Height Regulation)," July 1981, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA-450/4-80-023. (NTIS PB82 145301)

(2) "Guideline for Use of Fluid Modeling to Determine Good Engineering Practice Stack Height," July 1981, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA-450/4-81-003. (NTIS PB82 145327)

(3) "Guideline for Fluid Modeling of Atmospheric Diffusion," April 1981, U.S. Environmental Protection Agency, Environmental Sciences Research Laboratory, EPA-600/8-81-009. (NTIS PB81 201410)

II. Program Overview

A. The Problem

There are two general methods for preventing violations of the NAAQS and PSD increments. Emission controls reduce, on a continuous basis, the quantity, rate, or concentrations of pollutants released into the atmosphere from a source. In contrast, dispersion techniques rely on the dispersive effects of the atmosphere to carry pollutant emissions away from a source and to prevent high concentrations of pollutants near the source. The Clean Air Act requires pollution sources to meet the NAAQS and PSD increments by complying with emission limitations instead of relying on dispersion techniques.[1] Section 123 defines stack height exceeding GEP as a dispersion technique.

Tall stacks and intermittent or supplemental control systems (ICS or SCS) are the two basic types of dispersion techniques. Tall stacks enhance dispersion by releasing pollutants into the air at elevations high above ground level, increasing the volume of air through which pollutants must travel to reach the ground. Releasing pollu-

[1] See Sections 110(a)(2)(B), 123, 302(k), and 302(m) of the Act, 42 U.S.C. 7410(a)(2)(B), 7423, 7602(k), and 7602(m). The Notice of Proposed Rulemaking contains a more detailed discussion of the Act's prohibition of the use of dispersion techniques. See 44 FR 2608-2610.

tants from a tall stack allows a source to reduce the ambient levels of its pollution as measured at ground level without reducing the amount of pollution it releases. Intermittent and supplemental control systems vary a source's rate of emissions to take advantage of meteorological conditions. When atmospheric conditions do not favor dispersion and an NAAQS may be violated, the source temporarily reduces its pollutant emissions. When conditions favor rapid dispersion, the source emits pollutants at higher rates.

Use of dispersion techniques instead of constant emission controls can result in additional atmospheric loadings which may contribute to undesirable environmental effects. The use of tall stacks increases the possibility that pollution will travel long distances before it settles to the ground.

Although dispersion techniques may produce adverse effects, some stack height is needed to prevent excessive concentrations of pollutant emissions created by airflow disruptions caused by structures, terrain features, and ground-level meteorological phenomena. These excessive concentrations result from interference with the plume. Section 123 responds to this problem by allowing EPA to give a source credit for that portion of its stack height needed to prevent excessive concentrations near the source. This height is called GEP stack height.

The regulations promulgated today define "excessive concentrations," "nearby," and other important concepts. They also establish methods for determining the GEP stack height for all stationary sources to which these regulations apply.

B. The Program

These regulations do not limit the physical stack height of any source, nor require any specific stack height for any source. Instead, they set limits on the maximum

stack height credit to be used in ambient air quality modeling for the purpose of setting an emission limitation and calculating the air quality impact of a source. Sources are modeled at the physical stack height unless that height exceeds their GEP stack height. The regulations apply to all stacks constructed and all dispersion techniques implemented since December 31, 1970.

1. Methods of Determining GEP Stack Height. The regulations establish three basic methods of calculating a source's GEP stack height.

(a) De minimis height—EPA is adopting 65 meters as the minimum GEP stack height for all sources regardless of the size or location of any structures or terrain features. Sixty-five meters represents a reasonable estimate of the height needed to insure that emissions will not be affected by common ground-level meteorological phenomena which may produce execessive pollutant concentrations. Typical causes of these phenomena include surface roughness and the temperature changes caused by the solar heating and terrestrial cooling cycle (see page 26 of the Technical Support Document).

Virtually all significant sources of SO_2 can justify stack height credits greater than 65 meters. Accordingly, this de minimis height will have little effect on atmospheric loadings of sulfur dioxide.

(b) Mathematical Formulas—Excessive concentrations may be produced by downwash, wakes, and eddies caused by structures located near the stack. EPA is adopting two formulas with which to calculate the GEP stack height: One for stacks in existence on January 12, 1979 (the date of publication of EPA original proposed rules), and one for stacks constructed after that date.

For stacks in existence on January 12, 1979, EPA has adopted the traditional engineering formula of two and one-half times the height of the nearby structure (H_g=2.5H) as the formula for determining the GEP

stack height. For stacks constructed after January 12, 1979, EPA has established a refined formula of the height of the nearby structure plus one and one-half times the height or width of the structure, whichever is less (H_g=H+1.5L) as the formula for determining the GEP stack height.

(c) Physical Demonstration—In some cases, a source may need a stack taller than the height predicted by the formulas to prevent excessive concentrations of a pollutant due to downwash, wakes, or eddies created by structures or terrain obstacles. In such cases, Section 123 provides that a source may obtain credit for all of the stack height necessary to avoid excessive concentrations provided it demonstrates to the satisfaction of the reviewing authority that the additional height is necessary.

EPA is requiring such a source to demonstrate that maximum concentrations caused by the source's emissions from its proposed stack height, without consideration of nearby structures or terrain obstacles will increase by at least 40 percent when the effects of the structures or terrain obstacles are considered. This difference in concentrations must be shown either by a fluid model study conducted in accordance with guidelines published by EPA or by a field study which has been approved by the reviewing authority.

Before a source can obtain credit for a GEP stack height determined by a fluid model or field study demonstration, Section 123(c) requires that the reviewing authority must notify the public of the availability of the source's demonstration study and must provide an opportunity for a public hearing.

2. Method of Adjusting GEP Stack Height for Elevated Terrain Areas. As traditionally defined, plume impaction occurs when a plume emitted from a stack interacts with terrain that is taller than the stack. The contact between the plume and the terrain can produce

high pollutant concentrations. EPA is establishing a procedure which will allow sources to adjust their GEP stack height to avoid modeled plume impaction on elevated terrain causing one to predict violations of the NAAQS or applicable PSD increments which will not occur. (This procedure is explained in Section IV.C.) The predicted violations will not occur because the physical stack height is sufficient to ensure that the plume passes over the elevated terrain.

Before a source can obtain credit for a GEP stack height based on allowances for terrain impaction, the reviewing authority must notify the public of the availability of the source's demonstration study and must provide an opportunity for a public hearing.

3. Grandfathered Stack Height. The 1970 Clean Air Act became effective on December 31, 1970. Prior to that date some sources had constructed stacks taller than their GEP height. In Section 123, Congress recognized this and exempted those sources' stack heights. Section 123 allows credit for stack height in existence on December 31, 1970. A source's stack is considered to be "in existence" if that stack was part of the design of a facility on which construction commenced prior to December 31, 1970.

4. Other Dispersion Techniques. The regulations prohibit the use of other dispersion techniques to attain or maintain any NAAQS or protect a PSD increment. Those techniques include major alteration of plume characteristics such as the manipulation of exhaust flow rates or temperatures for the purpose of enhancing plume rise. The regulation defines three types of dispersion techniques: (1) tall stacks, (2) use of ICS or SCS, and (3) addition of a fan or reheater to obtain a less stringent emission limitation. However, the regulations exempt (1) reheating of a gas stream following the use of a pollutant control system, (2) smoke management in agricultural or silvicultural programs, and (3) combining exhaust gases from several stacks into one stack.

III. State Implementation Plan Requirements

EPA is establishing a two-stage process for the implementation of these regulations. All States must review and revise, as necessary, their SIPs to include provisions that limit stack height credits and dispersion techniques in accordance with these regulations. Section 406(d)(2) of the Clean Air Act Amendments of 1977 requires that these SIP revisions be submitted within nine months of promulgation of these regulations.

After EPA approves a State's stack height rules, the State must review existing limitations to determine whether these limitations have been affected by stack height credit above GEP levels or any other dispersion technique. If so, the State must revise the emission limitations to be consistent with its revised SIP.

IV. Changes in the Regulations From the October 7, 1981 Proposal

EPA has made several changes in the proposed regulations as a result of the public comments on the reproposed regulations. These changes are noted below.

A. Prospective Application of the New GEP Formula

On February 18, 1976 (41 FR 7450), EPA published the "Stack Height Increase Guideline" which provided guidance on its policy for the use of tall stacks. The guideline permitted credit for stacks up to two and one-half times the height of the facility it served. On November 3, 1977, after passage of the Clean Air Act Amendments of 1977, EPA promulgated a final rule on some changes to its prevention of significant deterioration (PSD) program (42 FR 57459). As part of the preamble to that notice, EPA defined GEP as "two and one-half times the height of the source" (2.5H).

On January 12, 1979 (44 FR 2608), EPA proposed regulations to implement Section 123 which refined the

two and one-half times rule by defining GEP stack height as the height of a nearby structure plus one and one-half times the lesser of the height or width of the nearby structure (H+1.5L). That proposal and the reproposal of that regulation on October 7, 1981 (46 FR 49814) would have made the new formula retroactive to December 31, 1970.

Four commenters argued that EPA's definition of GEP, until January 12, 1979, had been based on two and one-half times the building height and that sources in good faith had constructed stacks in accordance with that definition. Applying the new formula retroactively would be unfair to those sources. The commenters argued that the new formula should be applied prospectively.

In response to these comments, EPA has developed two formulas for determining GEP stack height: (1) For stacks in existence on January 12, 1979, the formula is H_g=2.5H; (2) for all other stacks, the formula is H_g=H+1.5L.

B. Definition of "in existence"

Section 123 does not affect stack heights "in existence" on December 31, 1970. In October 1981, EPA proposed to define "in existence" to mean that the owner or operator of a stack had obtained all necessary preconstruction permits or approvals required by Federal, State or local air pollution control agencies, and either (1) actually commenced construction, or (2) entered into a binding commitment for construction.

Comments on the reproposed definition stated that this new definition would discriminate unfairly against sources located in the few States or local jurisdictions which required construction permits for air pollution sources in 1970. (There were no Federal permit programs in 1970.) EPA agrees that the reproposed definition might operate unfairly. EPA has deleted the requirement for such ap-

provals or permits in determining whether a source's stack is "in existence" as of December 31, 1970.

However, the regulations now apply the two and one-half times formula for determining GEP only to stacks "in existence" on January 12, 1979. Federal requirements for preconstruction permits for air pollution sources were effective well before 1979. Accordingly, EPA is retaining the permit requirement for sources which want to claim credit for stacks "in existence" as of January 12, 1979. EPA has changed § 51.1(ii), which defines GEP, to require sources wishing to use the two and one-half times formula to show that they had obtained, prior to January 12, 1979, all preconstruction permits required by 40 CFR Parts 51 and 52.

The remaining portions of the definition of "in existence" are identical to the October 1981 proposal.

C. Impaction Credit

Many comments on the January 1979 proposal asked EPA to provide stack height credit for a source which experiences plume impaction. Plume impaction occurs when a plume emitted from a stack interacts with a terrain feature that is taller than the stack. The contact between the plume and the terrain feature can produce high pollutant concentrations, especially under stable atmospheric conditions in which the plume disperses slowly.

EPA decided that sources should receive stack height credit when impaction produces concentrations high enough to violate an NAAQS or applicable PSD increment. EPA included in its October 1981 reproposal a procedure for determining the amount of credit needed to prevent plume impaction.

EPA has received three types of comments on the proposed impaction credit. Environmental groups claimed that Section 123 does not authorize impaction credits. Several industrial commenters asked EPA to clarify the

proposed procedures for impaction credits. Finally, some industrial commenters asked EPA to modify a portion of its proposed procedures. To respond to these comments, EPA is presenting below a brief description of its rationale and procedures for impaction credits. EPA is also providing a brief explanation of its reason for declining to make procedural modifications.

(1) Rationale

Plume impaction resembles downwash, wakes, and eddies. In all of these events, structures or terrain features interfere with plume dispersion. If the interference occurs relatively close to the stack, before the plume has had adequate opportunity to disperse, high concentrations of pollutants can occur.

In enacting Section 123, Congress decided that sources should be allowed sufficient stack height credit to prevent high pollutant concentrations caused by downwash, wakes, and eddies. Congress called this height "good engineering practice." Any additional stack height was to be regarded as a dispersion technique that might allow a source to relax its emissions limitations. Section 123 does not mention impaction. However, neither the language of the statute nor the legislative history show that this omission was deliberate. EPA considers impaction to be enough like downwash that the same rationale should apply. GEP stack height should include credit needed to avoid high concentrations caused by impaction. Accordingly, EPA has decided to exercise general rulemaking authority to establish stack height credit needed to prevent high concentrations caused by plume impaction.

EPA recognizes Congress did not want the stack height rules to grant too much credit to sources locating in complex terrain, for "the result could be an open invitation to raise stack heights to unreasonably high elevations." H.R. Rep. No. 95-294, 95th Cong., 1st Sess.

at 93 (1977). Therefore, EPA has carefully tailored impaction credit procedures to provide only the minimum stack height credit needed to avoid high concentrations [2] produced by impaction. These procedures are described in more detail below.

EPA is convinced that its narrowly drawn rules represent a reasonable solution for a plume effect that closely resembles the phenomena of downwash, wakes, and eddies. Credits for plume impaction, when carefully limited, should not be regarded as a dispersion technique. Although the promulgated procedure allows for the use of some stack height to avoid high pollutant concentrations on elevated terrain, it does not permit excessive dispersion credits.

(2) Explanation of Procedures

EPA has developed a three-step procedure for determining the amount of stack height credit appropriate for a source with a predicted impaction concentration violating an NAAQS or applicable PSD increment.

First, a source must determine its downwash GEP height—the amount of stack height that can be justified based on downwash, wakes, or eddies—using any of the three methods described in Section II.B. above. Using this GEP height, the source must show that its plume would come into contact with elevated terrain (defined as terrain taller than this GEP height) and together

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[2] EPA considers "high concentrations" to be a violation of an NAAQS or applicable PSD increment. Unlike "excessive concentrations" caused by downwash, high concentrations caused by plume impaction occur in different meteorological conditions than downwash and are longer in duration. High concentrations due to plume impaction can be compared easily to an NAAQS or applicable PSD increment. Therefore, EPA has required that the concentration caused by plume impaction must be in excess of an NAAQS or applicable PSD increment before a source can adjust its GEP stack height.

with background concentrations cause a violation of an NAAQS or applicable PSD increment. If the source cannot show that a violation would occur, it cannot claim any impaction credit. Its stack height credit would be limited to the GEP height already calculated.

If a violation is modeled, the second step is to determine the source's maximum allowable emission limitation. In this step the source would model its air quality impact using the previously determined GEP height and assuming that the terrain feature(s) causing impaction is no taller than its downwash GEP height. Using the appropriate maximum concentration from this modeling scenario, the source would calculate an emission limitation which would become its maximum allowable emission limitation.

The third step allows the source to adjust its GEP stack height to account for the plume impaction on actual terrain features above the downwash GEP stack height. The source cannot adjust its maximum allowable emission limitation. The source would model its air quality impact again, this time using actual terrain elevations, but limiting its emissions to the rate fixed by the emission limitation developed in step two. The source would increase the height of the stack in the model to the height at which the maximum concentration predicted to occur on elevated terrain equaled the maximum concentration predicted to occur in step two. This increased stack height is the source's maximum GEP height to avoid high concentrations due to impaction.

Like the downwash GEP height, this stack height will represent maximum allowable credit. The source would not be able to claim this credit if its physical (actual or proposed) stack height were not as tall as its maximum creditable height. In that case, the source would be able to claim only its physical stack height. A source with physical stack height lower than its allowable GEP height would have to adjust its emission limitation down-

ward to prevent a violation of an NAAQS or applicable PSD increment.

(3) Modification Requested by Commenters

The electric utilities requested that EPA assume, during the Step two modeling, that all terrain features are no taller than ground elevation at the base of the stack or, in other words, that the source is located in absolutely flat terrain. The utilities believe that this assumption is necessary to ensure equity between sources located in elevated terrain and sources in flat terrain.

EPA has decided not to make this change to its procedure. EPA's objective is to provide the minimum stack height credit needed to allow a source to avoid high concentrations caused by plume impaction. A source in assumed flat terrain would obtain a less restrictive emission limitation than a source in terrain assumed to be as tall as its downwash GEP height. The flat terrain assumption would thus allow a source to obtain more stack height credit than needed to prevent impaction. It would also have a greater negative impact on air quality by allowing taller stacks and more relaxed emission limits.

D. Dispersion Technique

EPA received numerous comments on the definition of the term "dispersion technique." Most of these comments stated that wording concerning the enhancement of plume rise was vague. Comments specifically mentioned that many changes in operation or equipment made for engineering purposes, to improve reliability or efficiency, could be construed as a dispersion technique. This is not the intent of the definition. EPA has changed the definition of dispersion technique to prevent the addition of a fan or reheater to obtain a less stringent emission limitation. The purpose of this change is to prevent only the installation of equipment clearly intended to

enhance plume rise. The new definition should not prevent equipment changes intended to improve reliability and efficiency.

E. Definition of "Stack"

Comments on the January 1979 proposal urged EPA to exempt "flares" from the definition of "stack." EPA agreed that flares, which are designed to dispense heat and vent emissions intermittently for safety purposes, do not serve the same purpose as stacks, which are typically a source's major and most constant emissions point. EPA announced that it would exempt flares from the stack height regulations in the preamble to the October 1981 reproposal. New comments urged EPA to include this exemption in the regulations themselves to eliminate any potential for confusion or misunderstanding. In response to these comments, EPA is incorporating a specific exemption for flares into the definition of "stack."

F. Section 123 and Physical Stack Height

EPA received several comments on the October 1981 reproposal which indicated that the commenters believed that the proposed regulations would give EPA authority to limit a source's actual stack height. EPA did not intend to create this impression. In fact, EPA stated in the preamble to the reproposal that Section 123 expressly prohibits the Agency from limiting physical stack height. Section 123 limits only the theoretical stack height used in determining a source's emission limitation. However, to eliminate this confusion, EPA is adding a statement to §§ 51.12(j) and 51.18(l) of the regulations stating that these regulations do not restrict in any manner the actual height of any stack at any source.

G. Measurement of Stack Height

In the proposed definition of a "stack," EPA stated that the "stack height is the distance from the ground-level elevation of the plant to the elevation of the stack

outlet." Several commenters requested clarification in the [sic] establishing the ground-level elevation of the plant. For instance, the commenters noted that where a plant was built on a slope the regulation could have varying interpretations. Also, some commenters asked whether the entire plant site should be included or just the portion of the plant site considered "nearby" the stack.

EPA is changing the regulations to clarify this point. EPA deleted from the definition of a "stack," the statement defining stack height. However, EPA clarified the methods for determining GEP stack height by stating that all stack and structure heights are measured from the ground-level elevation at the base of the stack.

If a stack is on top of a building, the ground-level elevation of the building is used as the base elevation. In order to appropriately assess the impact of nearby structures on this stack height, the height of structures is also determined relative to the ground-level elevation of the stack.

H. Minor Wording Changes

Several commenters identified typographical errors and areas where minor wording changes could clarify the regulations. These and other wording changes have been made to correct and to clarify the regulations. These changes did not have any significant effect on the regulations.

V. Impact Analysis

EPA has prepared a series of impact analyses on these regulations. These analyses are in Docket A-79-01. The analyses show that the expected "worst-case" national annual costs to fossil-fuel fired power plants should be less than $45 million per year. These costs result from conservative estimates of required purchases of lower sulfur coal and estimates of required retrofit of electrostatic precipitators at some plants which purchase the

lower sulfur coal. The worst-case analyses show that the expected reduction in SO_2 emissions is less than 200,000 tons per year. Nationally, these costs could increase electric utility rate charges approximately 0.1 to 0.2 percent. Increases for individual power company rates could range from 0.5 to 30 percent.

VI. Regulatory Flexibility Analysis

Pursuant to the provisions of 5 U.S.C. 605(b), I hereby certify that the attached rule will not have significant economic impact on a substantial number of small entities. This rule applies only to large sources. The impact assessment predicted that these regulations would not have significant impact on any small entities. Based upon our impact analysis, only electric utility plants and possibly one smelter will be significantly affected by these regulations.

VII. Executive Order 12291

Under Executive Order 12291, EPA must judge whether a regulation is "major" and therefore subject to the requirement of a Regulatory Impact Analysis. This regulation is not "major" because it does not result in an annual effect on the economy of $100 million, nor does it result in a major increase in costs or prices for consumers, Federal, State, or local governments or individual industries, including the electric power industry.

VIII. Judicial Review

EPA believes that this rule is based on determinations of nationwide scope and effect. Nothing in Section 123 limits its applicability to a particular locality, State, or region. On the contrary, Section 123 applies to sources wherever located. Because of the rule's national applicability, Section 307(b) (42 U.S.C. 7607(b)) requires that any petition for review of the promulgated rule be filed only in the United States Court of Appeals for the Dis-

trict of Columbia and within 60 days of the date of publication.

(Secs. 110, 123, 301, Clean Air Act as amended (42 U.S.C. 7410, 7423, and 7601)

Dated: January 31, 1982.

John W. Hernandez, Jr.,

Acting Administrator.

PART 51—REQUIREMENTS FOR PREPARATION, ADOPTION, AND SUBMITTAL OF IMPLEMENTATION PLANS

Part 51 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 51.1 is amended by revising paragraph (z) and by adding paragraphs (ff), (gg), (hh), (ii), (jj), (kk), (ll), and (mm) as follows:

§ 51.1 Definitions.

* * * * *

(z) "Emission limitation" and "emmission standard" mean a requirement established by a State, local government, or the Administrator which limits the quantity, rate, or concentration of emissions of air pollutants on a continuous basis, including any requirements which limit the level of opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures for a source to assure continuous emission reduction.

* * * * *

(ff) "Stack" means any point in a source designed to emit solids, liquids, or gases into the air, including a pipe or duct but not including flares.

(gg) "A stack in existence" means that the owner or operator had (1) begun, or caused to begin, a continuous program of physical on-site construction of the stack or (2) entered into binding agreements or contractual obli-

gations, which could not be cancelled or modified without substantial loss to the owner or operator, to undertake a program of construction of the stack to be completed in a reasonable time.

(hh) "Dispersion technique" means any technique which attempts to affect the concentration of a pollutant in the ambient air by using that portion of a stack which exceeds good engineering practice stack height, varying the rate of emission of a pollutant according to atmospheric conditions or ambient concentrations of that pollutant, or by addition of a fan or reheater to obtain a less stringent emission limitation. The preceding sentence does not include: (1) The reheating of a gas stream, following use of a pollution control system, for the purpose of returning the gas to the temperature at which it was originally discharged from the facility generating the gas stream; (2) the use of smoke management in agricultural or silvicultural programs; or (3) combining the exhaust gases from several stacks into one stack.

(ii) "Good engineering practice (GEP) stack height" means the greater of;

(1) 65 meters;

(2) (i) For stacks in existence on January 12, 1979 and for which the owner or operator had obtained all applicable preconstruction permits or approvals required under this [sic] Parts 51 and 52 of this Title 40, $H_g=2.5H$

(ii) for all other stacks,

$H_g=H+1.5L$, where

H_g=good engineering practice stack height, measured from the ground-level elevation at the base of the stack,

H =height of nearby structure(s) measured from the ground-level elevation at the base of the stack,

L =lesser dimension (height or projected width) of nearby structure(s);

(3) The height demonstrated by a fluid model or a field study approved by the reviewing agency, which ensures that the emissions from a stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, or eddy effects created by the source itself, structures, or terrain obstacles.

(jj) "Nearby" as used in § 51.1(ii)(2) is that distance up to five times the lesser of the height or the width dimension of a structure but not greater than 0.8 km (one-half mile). The height of the structure is measured from the ground-level elevation at the base of the stack.

(kk) "Excessive concentrations" for the purpose of determining good engineering practice stack height in a fluid model or field study means a maximum concentration due to downwash wakes, or eddy effects produced by structures or terrain features which is at least 40 percent in excess of the maximum concentration experienced in the absence of such downwash, wakes, or eddy effects.

(ll) "Plume impaction" means concentrations measured or predicted to occur when the plume interacts with elevated terrain.

(mm) "Elevated terrain" means terrain which exceeds the elevation of the good engineering practice stack as calculated under paragraph (ii) of this section.

2. Section 51.12 is amended by adding paragraphs (j), (k), and (l) as follows:

§ 51.12 Control strategy: General.

* * * * *

(j) The plan must provide that the degree of emission limitation required of any source for control of any air pollutant must not be affected by so much of any source's stack height that exceeds good engineering practice or by any other dispersion technique, except as provided in § 51.12(k) and (l). The plan must provide that before a State submits to EPA a new or revised emission limita-

tion that is based on a good engineering practice stack height that exceeds the height allowed by § 51.1(ii)(1) or (2), the State must notify the public of the availability of the demonstration study and must provide opportunity for public hearing on it. This Section does not require the plan to restrict, in any manner, the actual stack height of any source.

(k) The provisions of §§ 51.12(j) and 51.18(l) shall not apply to (1) stack heights in existence, or dispersion techniques implemented prior to December 31, 1970, or (2) coal-fired steam electric generating units, subject to the provisions of Section 118 of the Clean Air Act, which commenced operation before July 1, 1957, and whose stacks were constructed under a construction contract awarded before February 8, 1974.

(l) The good engineering practice (GEP) stack height for any source seeking credit because of plume impaction which results in concentrations in violation of national ambient air quality standards or applicable prevention of significant deterioration increments can be adjusted by determining the stack height necessary to predict the same maximum air pollutant concentration on any elevated terrain feature as the maximum concentration associated with the emission limit which results from modeling the source using the GEP stack height as determined in § 51.1(ii) and assuming the elevated terrain features to be equal in elevation to the GEP stack height. If this adjusted GEP stack height is greater than the stack height the source proposes to use, the source's emission limitation and air quality impact shall be determined using the proposed stack height and the actual terrain heights.

3. Section 51.18 is amended by adding paragraph (l) as follows:

§ 51.18 Review of new sources and modifications.

* * * * *

(l) Such procedures must provide that the degree of emission limitation required of any source for control of any air pollutant must not be affected by so much of any source's stack height that exceeds good engineering practice or by any other dispersion technique, except as provided in § 51.12(k) and (l). Such procedures must provide that before a State issues a permit to a source based on a good engineering practice stack height that exceeds the height allowed by § 51.1(ii)(1) or (2), the State must notify the public of the availability of the demonstration study and must provide opportunity for public hearing on it. This section does not require such procedures to restrict, in any manner, the actual stack height of any source.

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ENVIRONMENTAL PROTECTION AGENCY

[40 CFR, Part 51]

USE OF SUPPLEMENTARY CONTROL SYSTEMS AND IMPLEMENTATION OF SECONDARY STANDARDS

Preparation, Adoption, and Submittal of Implementation Plans

On August 14, 1971 (36 FR 15486), the Administrator promulgated as 40 CFR, Part 420, regulations for the preparation, adoption, and submittal of State Implementation Plans (State plan guidelines) under section 110 of the Clean Air Act, as amended. These regulations were republished November 25, 1971 (36 FR 22398), as 40 CFR, Part 51. The amendments proposed herein would revise 40 CFR, Part 51 by making certain modifications and additions.

The proposed amendments would allow selective use of supplementary control systems as a means of attaining and maintaining the national ambient air quality standards (referred to hereafter as "national standards") in cases where permanent production curtailment, shutdown, or delays in attainment of the national standards are the only other alternatives. The proposed amendments also clarify policies on the use of increased stack height to take advantage of the dispersive effects of the atmosphere; modify the definition of "reasonable time" for attainment of secondary national ambient air quality standards; and modify guidelines for preparation of future State Implementation Plan revisions related to attainment and maintenance of national standards for sulfur dioxide and particulate matter.

Acceptability of Increased Stack Height

Effective and reliable operation of a supplementary control system often can be enhanced by increasing the

stack height beyond what would normally be considered good engineering practice. For purposes of this discussion a stack which conforms to good engineering practice is sufficiently tall that emissions from the stack are not significantly affected by the atmospheric downwash, eddies, or wakes created by the facility or nearby structures and terrain. Emissions from stacks which are shorter than required by good engineering practice often can cause excessively high ground level concentrations and nuisances within, and in the immediate vicinity of, the facility. For fairly level terrain, good engineering practice will normally result in stack height approximately two and one-half times the height of the facility and nearby obstructions. For more complex situations, this rule-of-thumb is too simplistic, and detailed engineering and meteorological investigations of the proposed site should be conducted to determine the appropriate stack height. The use of stack height up to the level of good engineering practice is encouraged by EPA in order to avoid local nuisances. But although the Environmental Protection Agency will accept existing stacks, it will not credit, as an acceptable portion of an air pollution control strategy, any extension of stack height beyond that of good engineering practice unless the extension is accomplished as part of an approved supplementary control system.

* * * *

§ 51.13 Control strategy: Sulfur oxides and particulate matter.

* * * *

(h) The increase of stack height up to a height consistent with good engineering practice is acceptable without qualification. An increase in stack height beyond this level is not an acceptable air quality control measure unless accomplished as part of an approved supplementary control system (see Appendix P to this part).

A stack which conforms to good engineering practice is sufficiently tall that emissions from the stack are unaffected by the atmospheric downwash, eddies and wakes which may be created by the facility itself, nearby structures or terrain obstacles.

For fairly level terrain, good engineering practice is normally taken to be a stack height 2½ times the height of the facility or nearby structure. For complex terrain, the 2½ times rule-of-thumb is too simplistic. For such cases, and for more detailed information on good engineering practices, the references listed should be consulted.

REFERENCES

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THE CLEAN AIR ACT

Sec. 101(a) The Congress finds—

(1) that the predominant part of the Nation's population is located in its rapidly expanding metropolitan and other urban areas, which generally cross the boundary lines of local jurisdictions and often extend into two or more States;

(2) that the growth in the amount and complexity of air pollution brought about by urbanization, industrial development, and the increasing use of motor vehicles, has resulted in mounting dangers to the public health and welfare, including injury to agricultural crops and livestock, damage to and the deterioration of property, and hazards to air and ground transportation;

(3) that the prevention and control of air pollution at its source is the primary responsibility of States and local governments; and

(4) that Federal financial assistance and leadership is essential for the development of cooperative Federal, State, regional, and local programs to prevent and control air pollution.

(b) The purposes of this title are—

(1) to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population;

(2) to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution;

(3) to provide technical and financial assistance to State and local governments in connection with the development and execution of their air pollution prevention and control programs; and

(4) to encourage and assist the development and operation of regional air pollution control programs.

Sec. 110. (a)(1) Each State shall, after reasonable notice and public hearings, adopt and submit to the Administrator, within nine months after the promulgation of a national primary ambient air quality standard (or any revision thereof) under section 109 for any air pollutant, a plan which provides for implementation, maintenance, and enforcement of such primary standard in each air quality control region (or portion thereof) within such State. In addition, such State shall adopt and submit to the Administrator (either as a part of a plan submitted under the preceding sentence or separately) within nine months after the promulgation of a national ambient air quality secondary standard (or revision thereof), a plan which provides for implementation, maintenance, and enforcement of such secondary standard in each air quality control region (or portion thereof) within such State. Unless a separate public hearing is provided, each State shall consider its plan implementing such secondary standard at the hearing required by the first sentence of this paragraph.

(2) The Administrator shall, within four months after the date required for submission of a plan under paragraph (1), approve or disapprove such plan or any portion thereof. The Administrator shall approve such plan, or any portion thereof, if he determines that it was adopted after reasonable notice and hearing and that—

(A) except as may be provided in subparagraph (I), (i) in the case of a plan implementing a national primary ambient air quality standard, it provides for the attainment of such primary standard as expeditiously as practicable but (subject to subsection (e)) in no case later than three years from the date of approval of such plan (or any revision thereof to take account of a revised primary standard); and (ii) in the case of a plan implementing a national secondary ambient air quality standard, it specifies a reasonable time at which such secondary standard will be attained;

(B) it includes emission limitations, schedules, and timetables for compliance with such limitations, and such other measures as may be necessary to insure attainment and maintenance of such primary or secondary standard, including, but not limited to, transportation controls, air quality maintenance plans, and preconstruction review of direct sources of air pollution as provided in subparagraph (D);

[PL 95-95, August 7, 1977]

(C) it includes provision for establishment and operation of appropriate devices, methods, systems, and procedures necessary to (i) monitor, compile, and analyze data on ambient air quality and, (ii) upon request, make such data available to the Administrator;

(D) it includes a program to provide for the enforcement of emission limitations and regulation of the modification, construction, and operation of any stationary source, including a permit program as required in parts C and D and a permit or equivalent program for any major emitting facility, within such region as necessary to assure (i) that national ambient air quality standards are achieved and maintained, and (ii) a procedure, meeting the requirements of paragraph (4), for review (prior to construction or modification) of the location of new sources to which a standard of performance will apply;

[PL 95-95, August 7, 1977]

(E) it contains adequate provisions (i) prohibiting any stationary source within the State from emitting any air pollutant in amounts which will (I) prevent attainment or maintenance by any other State of any such national primary or secondary ambient air quality standard or (II) interfere with measures required to be included in the applicable implementation plan for any other State under part C to prevent significant deteriora-

tion of air quality or to protect visibility, and (ii) insuring compliance with the requirements of section 126, relating to interstate pollution abatement;

[PL 95-95, August 7, 1977]

(F) it provides (i) necessary assurances that the State will have adequate personnel, funding, and authority to carry out such implementation plan, (ii) requirements for installation of equipment by owners or operators of stationary sources to monitor emissions from such sources, (iii) for periodic reports on the nature and amounts of such emissions; (iv) that such reports shall be correlated by the State agency with any emission limitations or standards established pursuant to this act, which reports shall be available at reasonable times for public inspection; (v) for authority comparable to that in section 303, and adequate contingency plans to implement such authority; and (vi) requirements that the State comply with the requirements respecting State boards under Section 128;

[PL 95-95, August 7, 1977]

(G) it provides, to the extent necessary and practicable, for periodic inspection and testing of motor vehicles to enforce compliance with applicable emission standards;

(H) it provides for revision, after public hearings, of such plan (i) from time to time as may be necessary to take account of revisions of such national primary or secondary ambient air quality standard or the availability of improved or more expeditious methods of achieving such primary or secondary standard; or (ii) except as provided in paragraph (3)(C), whenever the Administrator finds on the basis of information available to him that the plan is substantially inadequate to achieve the national ambient air quality primary or secondary standard which it implements or to otherwise

comply with any additional requirements established under the Clean Air Act Amendments of 1977; and

[PL 95-95, August 7, 1977]

(I) it provides that after June 30, 1979, no major stationary source shall be constructed or modified in any nonattainment area (as defined in section 171(2) to which such plan applies, if the emissions from such facility will cause or contribute to concentrations of any pollutant for which a national ambient air quality standard is exceeded in such area, unless, as of the time of application for a permit for such construction or modification, such plan meets the requirements of part D (relating to nonattainment areas);

[PL 95-95, August 7, 1977]

(J) it meets the requirements of section 121 (relating to consultation), section 127 (relating to public notification), part C (relating to prevention of significant deterioration of air quality and visibility protection); and

[PL 95-95, August 7, 1977]

SEC. 123. (a) The degree of emission limitation required for control of any air pollutant under an applicable implementation plan under this title shall not be affected in any manner by—

(1) so much of the stack height of any source as exceeds good engineering practice (as determined under regulations promulgated by the Administrator), or

(2) any other dispersion technique.

The preceding sentence shall not apply with respect to stack heights in existence before the date of enactment of the Clean Air Amendments of 1970 or dispersion techniques implemented before such date. In establishing an emission limitation for coal-fired steam electric generating units which are subject to the provisions of

section 118 and which commenced operation before July 1, 1957, the effect of the entire stack height of stacks for which a construction project was awarded before February 8, 1974, may be taken into account.

(b) For the purpose of this section, the term "dispersion technique" includes any intermittent or supplemental control of air pollutants varying with atmospheric conditions.

(c) Not later than six months after the date of enactment of this section, the Administrator, shall after notice and opportunity for public hearing, promulgate regulations to carry out this section. For purposes of this section, good engineering practice means, with respect to stack heights, the height necessary to insure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies and wakes which may be created by the source itself, nearby structures or nearby terrain obstacles (as determined by the Administrator). For purposes of this section such height shall not exceed two and a half times the height of such source unless the owner or operator of the source demonstrates, after notice and opportunity for public hearing, to the satisfaction of the Administrator, that a greater height is necessary as provided under the preceding sentence. In no event may the Administrator prohibit any increase in any stack height or restrict in any manner the stack height of any source.

EXCERPTS FROM ENVIRONMENTAL RESEARCH AND TECHNOLOGY, ANALYSIS OF EPA PROPOSED REGULATIONS ON STACK HEIGHT LIMITATION (MARCH 1979) (SUBMITTED AS APPENDIX C TO COMMENTS OF THE UTILITY AIR REGULATORY GROUP (MARCH 7, 1979))

1. COMPARISON OF THE GEP REGULATIONS WITH THE EPA/FEA REPORT

1.1 Impacts on Plants Located in Elevated Terrain

In 1975, EPA and FEA initiated a joint study to assess the impacts of alternative approaches to prevention of significant deterioration. The EPA/FEA study published in October 1975 (EPA/FEA, 1975) analyzed 74 coal-fired power plants units that were planned to begin operation by 1983 to determine how many could comply with PSD increments. The analysis used EPA's CRSTER model to estimate the maximum sized plant which could be built for cases where the plant's stack is higher than the surrounding terrain. Terrain adjusted stack heights (i.e., the difference between the stack top and the surrounding terrain) of 0, 250, 500, 750 and 1000 ft were analyzed *. The analysis also used the EPA VALLEY model assumptions to calculate maximum plant size when the surrounding terrain was at least 500 ft higher than the plant's stack. Thus, the EPA/FEA report not only considered terrain below stack top but also cases where the plume would directly impact on terrain. In addition, neither building nor terrain-induced enhanced concentrations due to downwash were considered in the report. The choice of stack height is important in determining expected compliance with the PSD Class II increments in the region immediately surrounding each plant. When considering plume impaction elevated terrain cases

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* Vol. II, p. IV-1.

(i.e., terrain elevations exceeding stack tops by 500 ft), the EPA/FEA report indicated that a 1,000-Mw plant, even when operated at an emission rate of 0.12 lb/10^6 Btu (corresponding to the use of low sulfur Western coal and a continuously effective 90% removal efficiency scrubber) would use up the entire Class II 24-hour increment if terrain elevations exceeded stack top height by 500 feet within approximately 3 miles of the plant (EPA/FEA 1975)**.

By projection based on the EPA modeling methods, it can be concluded that a 5-mile radius excluding elevated terrain would be needed to site a 1,000-Mw new plant if the emission limitation were 0.2 lb/10^6 Btu. A greater radius excluding rough terrain is required if a larger site capacity is to be permitted or if less than 100% of the available increment is left for the new plant. This terrain consideration is important because the definition of elevated terrain is much more restrictive when stack height credits are constrained to values less than 500 feet, as would occur under the proposed stack height regulations for many power plants (see discussion under Section 2.3).

The House Report on HR 6161 comments as follows (p. 161):

> The committee's bill does not significantly restrict industrial development in areas of sloping or hilly terrain. According to the previously cited FEA-EPA studies, even a large 3500 mw powerplant could be built in rugged terrain—under this bill.

This statement may be misleading; Table C-5 of Volume II of the EPA/FEA report indicates that 3,500-Mw capacity could be permitted when low sulfur Western coal is used with a scrubber only if the plume impaction on

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** Vol. I, p. 3 and Vol. II, Table C-5.

elevated terrain were at least 12 kilometers (km) (approximately 7.5 miles) from the plant site. The House Report would thus suggest that major plants with stringent emission controls can be sited in rough terrain as long as the terrain elevations do not exceed stack heights within several miles surrounding the plants. Restrictions to allowable stack height severely limit the number of such sites, particularly along water sources in the mountainous, coal-producing regions of the country.

1.2 Comparison of Stack Height Restrictions (EPA/FEA Report, Proposed GEP Regulations)

Congress relied on the EPA/FEA findings that (1) generally, well-controlled power plants could be built at sites avoiding nearby terrain influences (i.e., no terrain above stack top within a few miles) and (2) specifically, most of the EPA/FEA actual 74-plant sample could be permitted if they were well controlled. However, the proposed (January 12) stack height regulations would restrict the stacks at the 74 plants as follows:

— Average stack height for the 74 plants, as actually planned .....587 feet

— Stack height used in the EPA/FEA analysis .....500 feet*

— Average stack height for the 74 plants permitted by proposed GEP regulations .....465 feet

The average GEP stack heights reported here are calculated from twice the average building height of the sample as was done in EPA's Draft Impact Assessment Report. Therefore, the adoption of the proposed GEP regulations would reduce the creditable stack heights for the 74 actually planned coal burning facilities studied in the EPA/FEA analysis by 21%. The GEP stack heights would also be 7.5% less than the 500-ft nominal height

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* Even though other stack heights were considered in the EPA/FEA analysis, the results reported for the 74 plant sample correspond to the 500 ft case.

adopted for the EPA/FEA analysis. Larger capacity facilities would generally experience even greater than average reductions of their planned stack heights; among the 74 plants sampled, the larger units generally have been planned with the larger stack heights. Plants to be located in mountainous areas are particularly sensitive to the loss of permissible stack height—lower stack heights result in a greater likelihood of nearby terrain impacts, excluding many candidate sites from consideration for new sources or requiring additional controls on existing sources.

As a separate issue, it should be noted that the EPA/FEA modeling analysis took no account of building and terrain induced downwash effects in determining the site emission limits associated with the power plants analyzed. The incorporation of downwash effects, leading to a possible 40% augmentation of maximum concentrations with a GEP stack height under the proposed guidelines would be a substantial change in the interpretation of the EPA/FEA modeling methodology and would not be consistent with that methodology.

1.3 Summary and Recommendations

To be consistent with the approach and methodology adopted in the EPA/FEA study, on which Congress relied in determining a PSD policy, the GEP regulations should consider appropriate modeling assumptions if terrain-induced impacts for all cases where elevated terrain occurs within several miles (for example, five miles) around a proposed major source are to be avoided. Further, the regulations should not imply that downwash enhanced concentrations must be considered for stack heights slightly less than GEP. Calculations of such enhanced concentrations are inconsistent with the EPA/FEA analysis approach and may not be realistic in actual situations. Most EPA regional offices presently allow enhanced concentrations due to downwash to be neglected when the actual (or proposed) stack height is at, or

slightly below GEP stack height. If EPA were to adopt this interpretation as uniform national policy, such policy would be consistent with the EPA/FEA report.

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3. MODEL CALCULATIONS FOR A TYPICAL LARGE POWER PLANT

The purpose of this section is to demonstrate the impact of the proposed stack height regulations on a typical large power plant. This analysis differs from that contained in the EPA Impact Assessment Report in that *actual* emissions reductions are predicted, not just an average for the industry. Since the GEP guidelines do not allow credit for reduced concentrations resulting from stacks that are higher than GEP heights, the analysis reported here indicates the emission reductions that are needed if a plant were evaluated with a GEP stack height instead of a greater actual height. The analysis assumes that plant concentration at actual stack height plus background just meets national ambient air quality standards (NAAQS). This assumption is made because any increase in concentration contributed by the source would result in an exceedance of the NAAQS and would have to be eliminated through an emissions reduction.

Calculations were made with EPA recommended diffusion models for both scrubbed and unscrubbed emissions from a power plant located at various distances from specified terrain features. The plant was modeled with a stack at a GEP height of 431 ft and an actual height of 695 ft. The GEP and actual stack heights were chosen because they represent the average of the 54 tall stacks considered in the EPA Impact Assessment Report (p. 13). The stack parameters for this plant are presented in Table 2. The concentrations are calculated on the basis of unit emission rates and are presented in units of ug/m^3 per g/s. The calculations are reported in these normalized units to show the relative differences in predicted plant concentrations for the various situations. The analysis

is based on reasonable assumptions for the stack characteristics of a typical plant, and calculations were made only for receptor points at distances of expected maximum concentrations; therefore, the results should be considered to be estimates only.

The following cases were analyzed for each of the two stack heights:

- flat terrain,
- short terrain, with a height of 430 ft (i.e., terrain just below the GEP stack height),

TABLE 2

STACK PARAMETERS

Parameter	GEP Stack *	Actual Stack *
Stack height (ft)	431	695
Stack gas temperature (°K):		
without controls	400	400
with controls	352	352
Volume flow (standard m^3/s)	314	314
SO_2 emission rate (g/s)	Unit (1.0)	Unit (1.0)

* GEP and actual stack heights are based on the average of 54 tall stacks reported in the EPA Impact Assessment Report, page 12.

- medium terrain, with a height of 690 ft (i.e., terrain just below the actual stack height), and
- the above cases with emission controls (scrubbers) on the GEP stack.

3.1 Model Assumptions

Normalized concentrations were calculated using the EPA CRSTER and PTMAX models and, for terrain above stack height, EPA VALLEY model assumptions. Hourly meteorological data for 1964 from two mid-continent sources were used in the CRSTER model. The data from the first source, referred to as station A, were

derived from surface observations at Springfield, IL, and upper air measurements from Peoria, IL. Data from the second source, referred to as station B, were developed from surface observations at St. Louis, MO, and upper air data, from Peoria, IL. The meteorological data sets were then used to calculate 3-hour and 24-hour concentrations resulting from the power plant emissions.

For the flat terrain case, the expected locations of the maximum 3- and 24-hour concentrations for both stack heights were determined from preliminary calculations with the PTMAX model. The location of the maximum hourly impact predicted either for stability A (very unstable) or stability B (unstable) was selected as a reasonable receptor location for the expected maximum 3-hour concentration. For the 24-hour concentration, the receptor location was based on the maximum impact estimated for stability C (slightly unstable) or stability D (neutral). Based on these assumptions, downwind distances of 1.0 and 3.75 km were obtained for the GEP stack height, and 3.0 and 5.8 km for the actual stack height.

For the short terrain case, the CRSTER model was used with a terrain feature of 430 ft elevation located 2.5 km downwind. Again, maximum 3- and 24-hour concentrations were calculated for both stack heights.

The medium terrain case considered terrain features of 690 ft elevation at 2.5 km downwind. Because the CRSTER model cannot be used for terrain height above the stack height, the EPA VALLEY model assumptions were used for the GEP stack height impact evaluation in this case. The VALLEY model predicts the 24-hour concentration by assuming that wind direction persists for 6 hours with a 2.5 m/s wind speed and a stable atmosphere. The 3-hour concentration is based on the persistance of the 1-hour concentration for 3 hours.

The calculations assumed that emissions from the typical large power plant were not scrubbed. Additional anal-

yses were conducted to determine what effect the addition of scrubbers would have on ground-level concentrations from the plant with a GEP stack. The addition of scrubbers would reduce the exit gas temperature of 400°K to about 352°K, allowing for reheating of the exit gas.

3.2 Discussion of Results

The results of the analyses are presented in Tables 3 and 4 for concentrations from the typical plant with uncontrolled and controlled emissions, respectively. The results indicate that substantial reductions in emissions would be required for an existing plant to meet ambient standards if no credit in concentration were given for stack heights greater than GEP height. The larger reductions are estimated for the 3- and 24-hour averages for plants that are near terrain features. These results also indicate that the choice of the meteorological data base did not significantly change the estimated reductions for the terrain cases. Based on these results, the following conclusions are drawn.

- For flat terrain cases, emission reductions greater than 50% are indicated for both sets of meteorological data for the 3-hour average cases. The change in allowed concentration is greater for the 3-hour averaging period than the 24-hour period in these cases.
- The required emission reduction in [sic] always greater when scrubbers are used together with the proposed GEP stack height (Table 4). This occurs because a significant part of the plume rise benefit is lost during the wet scrubbing process.
- In the short terrain case (i.e., where terrain features up to the GEP stack height occur) emission reductions of 50% to 80% are required to maintain a specified 24-hour maximum concentration impact when stack height credit is reduced from 695 ft (i.e., 265 ft above terrain) to the GEP credit of 431 ft.

TABLE 3

CONCENTRATIONS ESTIMATED FOR A TYPICAL LARGE POWER PLANT WITH GEP AND ACTUAL STACK HEIGHTS FOR VARIOUS TERRAIN FEATURES

Terrain Feature (ft)	Stack Data*	Concentration per Unit Emission Rate (ug/m^3 per g/s)†† 3-Hour Meteorological Data ** Station A	3-Hour Meteorological Data ** Station B	24-Hour Meteorological Data ** Station A	24-Hour Meteorological Data ** Station B
Flat	GEP	0.35	0.35	0.054	0.054
	Actual	0.21	0.20	0.031	0.026
	Percent reduction from GEP to actual	40	43	43	52
Short (430)	GEP	1.0	1.0	0.48	0.41
	Actual	0.35	0.50	0.10	0.097
	Percent reduction from GEP to actual	65	50	79	76
Medium (690)	GEP†	6.84	6.84	1.71	1.71
	Actual	1.16	1.04	0.46	0.42
	Percent reduction from GEP to actual	83	85	73	75

*GEP = 431 ft stack height; actual = 695 ft stack height.

**Station A = 1964 meteorological data from Springfield and Peoria, IL.
Station B = 1964 meteorological data from St. Louis, MO, and Peoria, IL.

†Calculations with VALLEY model assumptions.

††To obtain a SO_2 concentration in ug/m^3, multiply the calculated concentration by a specific emission rate in gm/s.

TABLE 4

CONCENTRATIONS ESTIMATED FOR A TYPICAL LARGE POWER PLANT ASSUMING A SCRUBBER WITH GEP STACK HEIGHT

Terrain Feature (ft)	Stack Data*	Concentration per Unit Emission Rate (ug/m³ per g/s)†† 3-Hour Meteorological Data ** Station A	3-Hour Meteorological Data ** Station B	24-Hour Meteorological Data ** Station A	24-Hour Meteorological Data ** Station B
Flat	GEP	0.48	0.40	0.061	0.063
	Actual	0.21	0.20	0.031	0.026
	Percent reduction from GEP to actual	56	50	49	59
Short (430)	GEP	1.57	1.44	0.64	0.61
	Actual	0.35	0.50	0.10	0.097
	Percent reduction from GEP to actual	78	65	84	84
Medium (690)	GEP†	11.20	11.20	2.80	2.80
	Actual	1.16	1.04	0.46	0.42
	Percent reduction from GEP to actual	90	91	84	85

*GEP = 431 ft stack height; actual = 695 ft stack height.

**Station A = 1964 meteorological data from Springfield and Peoria, IL.
Station B = 1964 meteorological data from St. Louis, MO, and Peoria, IL.

†Calculations with VALLEY model assumptions.

††To obtain a SO_2 concentration in ug/m³, multiply the calculated concentration by a specific emission rate in gm/s.

- In the moderate terrain case (i.e., where terrain features approach actual stack height within a few kilometers of the plant) emission reductions of 73% to 85% are required. In the case of scrubber use to meet the lower emission limit, total emission reductions could be as high as 91%.
- The details of moderate terrain calculations are related to the choice of CRSTER or VALLEY as the diffusion model for the impact analysis. Either model can require more restrictive emission reductions depending on the details of the individual case.
- Emission reductions reported here for the *flat terrain* case are about the same as those recorded in the EPA Impact Assessment Report. However, impacts on elevated terrain were not considered in the EPA report: emissions would have to be reduced as much as ten-fold in these cases. EPA's omission of the terrain impact cases seriously underestimates the economic impacts of the proposed regulation.
- For those existing plants with stack heights of 1,000 or 1,200 ft, the calculated effects would be much greater than those listed in Tables 3 and 4.

EXCERPT FROM EEA, INC., COST AND ECONOMIC IMPACT ANALYSIS OF THE PROPOSED STACK HEIGHTS REGULATION (AUGUST 15, 1980)

3. COST AND ECONOMIC IMPACTS

3.1 *COST IMPACTS*

The costs of the Stack Heights Regulation would result from costs of purchasing lower-sulfur coal and installing and operating flue gas desulfurization (FGD) systems. Generally, in order to achieve a given sulfur reduction, it is less costly to switch to a lower sulfur coal than to install a FGD system. However, under the proposed Stack Heights Regulation, some plants may be unable to meet their very low sulfur limitations (less than .7 percent sulfur content in the eastern states and less than .4 percent sulfur content in the midwestern and western states), and they may have to install FGD systems to comply with the regulation.

The costs of the regulation were calculated for two cases, the first assuming a 122 m (400 ft) GEP stack height and the second a 183 m (600 ft) GEP stack height. Costs, calculated on a plant by plant basis, were aggregated by EPA region, and by fuel costs versus FGD costs.

Total annualized costs for the U.S. would be $794 million assuming a 122 m (400 ft) GEP stack height and $223 million assuming a 183 m (600 ft) GEP stack height. These estimates should not be viewed as upper and lower bounds of the costs of the regulation. Rather, the 794 million per year estimate represents a worst case situation, including the assumption that 122 m (400 ft) is the maximum GEP stack height. Since many power plants will be able to qualify for a higher GEP stack height, the 122 m (400 ft) GEP stack height case represents a maximum cost impact situation and probably overestimates the actual cost of the regulation.

The study also provides an estimate of the costs assuming a 183 m (600 ft) GEP stack height, while retaining the remainder of the worst case assumptions of the 122 m (400 ft) GEP stack height case. Therefore, the 183 m (600 ft) GEP case represents the worst case situation where power plants are assumed to qualify for a 183 m (600 ft) GEP stack height.

Table 3-1 provides the costs of the 122 m (400 ft) GEP stack height case, and Table 3-2, the costs of the 183 m (600 ft) GEP stack height case. The fuel costs column represents the annual costs of switching to a lower sulfur coal to comply with the Stack Heights Regulation. The FGD costs column indicates the annualized costs of retrofitting an 85 percent SO_2 removal FGD system to the existing power plants.

Of the 104 power plants with the potential to be affected by the regulation, 19 would have to install FGD systems under the 122 m (400 ft) GEP case, while only two plants would need FGD systems under the 183 m (600 ft) GEP stack height. Only 23 of the 104 power plants would have no increased costs in the 122 m (400 ft) GEP case, while 67 would not be affected under the 183 m (600 ft) GEP case.

3.1.1 *122 m (400 ft) GEP Stack Height Case*

The 122 m (400 ft) GEP stack height case would result in a total annualized cost of $794 million, of which $771 million, or 97 percent, would be due to FGD costs. Increased coal costs account for the remaining $23 million per year costs of the regulation. The regional impacts of the regulation are readily apparent from Table 3-1. There would be no cost impacts in Regions I, II, or X; a small impact in Regions VII and VIII; and larger impacts in Regions III and IV. The two regions III and IV would account for $580 million per year or 73 percent of the total costs per year.

TABLE 3-1. REGIONAL COSTS OF STACK HEIGHTS REGULATION ASSUMING GEP EQUALS 122 m (400 ft)

REGION	Fuel Costs ($)	FGD Costs ($)	Total ($)
I	—	—	—
II	—	—	—
III	11,730,873	289,395,000	301,125,873
IV	(22,433,701)	301,165,263	278,731,562
V	30,855,621	91,148,379	122,004,000
VI	(2,071,248)	40,680,150	38,608,902
VII	6,010,912	—	6,010,912
VIII	365,788	—	365,788
IX	(1,234,697)	48,718,363	47,483,666
X	—	—	—
U.S. TOTAL	23,223,548	771,107,155	794,330,703

TABLE 3-2. REGIONAL COSTS OF STACK HEIGHTS REGULATION ASSUMING GEP EQUALS 183 m (600 ft)

REGION	Fuel Costs	FGD Costs	Total
I	0	0	0
II	0	0	0
III	99,082,739	0	99,082,739
IV	(6,166,554)	103,035,975	96,869,421
V	23,806,987	0	23,806,987
VI	0	0	0
VII	2,781,103	0	2,781,103
VIII	0	0	0
IX	0	0	0
X	0	0	0
U.S. TOTAL	119,504,275	103,035,975	222,540,250

Region III is composed of the following states:

- Delaware
- District of Columbia
- Maryland
- Pennsylvania
- Virginia
- West Virginia

Most of the impacts in this region will occur in Maryland, Pennsylvania, and West Virginia

Region IV contains the following states:

- Alabama
- Florida
- Georgia
- Kentucky
- Mississippi
- North Carolina
- South Carolina
- Tennessee

The states in Region IV with the highest costs are Alabama, Georgia, and North Carolina.

Capital costs for FGD systems are presented in Table 3-3. Total capital investment required would be $2.8 billion, with $2.1 billion of these capital costs occurring in Regions III and IV.

3.1.2 *183 m (600 ft) GEP Stack Height Case*

The costs of the 183 m (600 ft) GEP stack height case would be $223 million per year, $571 million less than in the 122 m (400 ft) GEP case. As can be seen in Table 3-2, most of this decrease in costs would be due to the lower FGD costs in the 183 m (600 ft) GEP case.

Since a 183 m (600 ft) GEP stack height would require much less reduction in sulfur emissions than a 122 m (400 ft) GEP stack height, many power plants would be able to switch to lower sulfur coal instead of installing FGD systems, resulting in substantial cost savings to these plants.

TABLE 3-3. REGIONAL FGD CAPITAL COSTS

Region	122 m (400 ft) GEP Case	183 m (600 ft) GEP Case
I	0	0
II	0	0
III	982,212,750	0
IV	1,101,747,488	350,240,314
V	333,369,734	0
VI	111,548,325	0
VII	0	0
VIII	0	0
IX	223,916,917	0
X	0	0
TOTAL U.S.	2,752,795,214	350,240,314

The regional costs of the regulation would be highly concentrated in Regions III and IV, which would account for 88% of the projected costs. Regions V and VII would have minor costs, while Regions I, II, VI, VIII, IX, and X would not be affected. Total capital costs for FGD systems would be $350 million, as shown in Table 3-3.

3.2 *ECONOMIC IMPACT*

The major economic impact of the Stack Heights Regulation would be to increase the cost of electricity to consumers. All of the costs of using lower sulfur coal or installing FGD systems are assumed to be passed on to the consumer, either through fuel adjustment clauses or rate increases. Nation-wide, the costs of the Stack Heights Regulation were estimated to be .05 cents/kWh

in the 122 m (400 ft) GEP case and .02 cents/kWh in the 183 m (600 ft) case, as shown in Table 3-4. The impact on electricity rates would be small; 1.3 percent in the 122 m (400 ft) GEP case and 0.5 percent in the 183 m (600 ft) GEP case.

However, while the economic impacts averaged across utilities would not be very high, the economic impact on the rates of individual utilities could be significant. Utilities in Regions III and IV would experience the largest economic impact with the rate increases ranging up to 26 percent (see Table 3-5).

TABLE 3-4. ECONOMIC IMPACT ON ELECTRICITY PRICES

	122 m (400 ft) GEP Case	183 m (600 ft) GEP Case
Average Retail Electricity Price (1979) (¢/kWh)	3.99	3.99
Increase in Price due to Stack Height Regulation	0.05	0.02
Percent Increase	1.3	0.5

TABLE 3-5. ECONOMIC IMPACT ON SELECTED UTILITIES

Utility	Region	1979 Average Retail Electricity Price (¢/kWh)	Increase in Price due to Stack Height Regulation (¢/kWh)		Percent Increase	
			122 m (400 ft) GEP Case	183 m (600 ft) GEP Case	122 m (400 ft) GEP Case	183 m (600 ft) GEP Case
A	III	3.32	.87	.11	26.2	3.3
B	III	4.28	.52	.09	12.2	2.1
C	IV	3.86	.27	.02	7.0	0.5
D	IV	3.61	.25	.18	6.9	5.0
E	IV	3.75	.16	.00	4.3	0.0